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Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 477 or 480 of the Canada Shipping Act (1985)

Rapport d'investigation au Ministre conformément aux articles 477 ou 480 de la Loi sur la marine marchande du Canada (1985)

Canada

Ce rapport est aussi disponible en français

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE FOUNDERING OF THE PANAMANIAN VESSEL "JOHANNA B" IN THE GULF OF ST. LAWRENCE ON DECEMBER 7, 1989

REPORT No. 553

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REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE FOUNDERING OF THE PANAMANIAN VESSEL "JOHANNA B" IN THE GULF OF ST. LAWRENCE ON DECEMBER 7, 1989

Particulars of Vessel

Name	"JOHANNA B" 1987, ex "JIN XING" 1986 and the "MONTAUK GANNET" 1983.
Official Number	13242-83-B
Port of Registry	Panama
Call Sign	3END2
Gross Tonnage	2,806
Net Tonnage	1,622
Length	91.6 m
Breadth	15.2 m
Depth	7.8 m
Draught (at departure from Sorel)	Derived (FW) F: 6.090 m A: 6.858 m Reported (SW) F: 5.92 m A: 6.73 m
Type	General cargo vessel
Built	1983, steel, Sanyo Shipyard Co. Ltd., Japan
Propulsion	One 6-cylinder Niigata diesel of 2,000 BHP engine driving a fixed pitch propeller
Cargo	4,611.81 tonnes of pig iron
Crew	16
Owners	Johanna Shipping Corporation, Panama
Canadian Agent	Gibson Shipping Ltd. Montreal, Quebec
Local Agent	Agences Maritimes de Sorel Inc. Sorel, Quebec
Classification	Bureau Veritas

Navigation Equipment

Radar 1	Kyoritsu Rams
Radar 2	Kyoritsu Rams
Radiogoniometer	Hokushin
Echo Sounder	Furuno, F 8515
Loran C	One
Sat Nav	One
VHF 1	Belcom, F-2509 P
VHF 2	Belcom, DC-731 A
SSB	Skanti, TRP 62515-S/N 486
Fax Receiver (weather)	Kyoritsu, FXH-876
Radiotelephone Alarm	Kyoritsu/2182
Gyro compass	Hokushin
Automatic Pilot	One

Details regarding the missing persons

Name	Roberto N. Naid
Age	40
Position aboard	Master
Address	Iloilo, Philippines
Name	Ricardo J. Prudente
Age	40
Position aboard	Mate
Address	Makati, Philippines
Name	Benjamin V. Gealon
Age	36
Position aboard	Second Mate
Address	Cebu, Philippines
Name	Rodolfo T. Casia
Age	50
Position aboard	Radio Officer
Address	Cebu, Philippines

Name	Doroteo P. Parreno
Age	52
Position aboard	Chief Engineer
Address	Pasay, Philippines
Name	Victorio Abello
Age	38
Position aboard	Second Engineer
Address	Pandacan, Philippines
Name	Ricardo V. Jara
Age	51
Position aboard	Electrician
Address	Quezon, Philippines
Name	Ralph D. Mission
Age	22
Position aboard	Chief cook
Address	Metro Manila, Philippines
Name	Nelson R. Domingo
Age	27
Position aboard	Messman
Address	Aglipay, Philippines
Name	Dary P. Mejia
Age	39
Position aboard	Boatswain
Address	Manila, Philippines
Name	Norman P. Almario
Age	21
Position aboard	Able Seaman
Address	Balacan, Philippines
Name	Nelson T. Maglanque
Age	25
Position aboard	Able Seaman
Address	Manila, Philippines
Name	Norberto G. Jr Navarro
Age	40
Position aboard	Able Seaman
Address	Roxas, Philippines
Name	Renato U. Ong
Age	33
Position aboard	Oiler
Address	Iloilo, Philippines

Name	Ricardo J. Placer
Age	33
Position aboard	Oiler
Address	Manila, Philippines

Name	Oscar P. Yarte
Age	41
Position aboard	Oiler
Address	Manila, Philippines

At the time of writing of this report, these victims are still missing and their case has been forwarded to the Royal Canadian Mounted Police as missing persons.

NOTE: All times in this report are expressed in Eastern Standard Time (UTC minus 5 hours).

Background

On December 6, 1989, a low pressure area was moving eastward from Ontario towards the Gulf of St. Lawrence. This trend accelerated quickly and the gale warning in force was upgraded to a storm warning. Seas developed more quickly than forecast and, some 24 hours later, vessels sailing in the Gulf were buffeted by storm force winds.

On December 7, to the south of Anticosti Island, in seas that occasionally reached 12 m in height, the cargo vessel "JOHANNA B" ran before the weather. As the storm force wind and seas broke on deck, the tarpaulins covering No.2 hold folded back and downflooding ensued until the vessel sank; the 16 crew were not found despite three days of intensive search and rescue operation.

Low pressure systems covering the Gulf of St. Lawrence and adjacent areas contributed to 2 other casualties, the cargo vessel "CAPITAINE TORRES" (23 victims) and the fishing vessel "JOHNNY & SISTERS II" (8 victims) during this period.

Narrative

The "JOHANNA B" arrived at Trois-Rivières, Quebec, from Savannah, Georgia at 2310, November 25, 1989. After unloading, at 0010 December 1, the ship sailed light from Trois-Rivières to Sorel, Quebec, where she anchored offshore at 0420 to await a berth.

On December 2, an inspection of the condition of the holds was carried out for the shipper by an independent firm of marine surveyors. The inspection showed that the condition was good and no major damage was discovered. Due to the intense cold temperatures, the holds were not washed but the china clay residue from a previous cargo was swept up. The ballast tanks remained

empty. The master expressed his concern to the marine surveyor about sailing in ice-infested waters. The vessel was not ice classed.

At 2040, the "JOHANNA B" was moored at berth No. 20 in Sorel awaiting loading with fore and aft draughts of 0.21 m and 3.81 m, respectively. By 1600 December 3, loading was completed. The bill of lading showed a load distribution of 1,891.56 tonnes and 2,720.25 tonnes in holds Nos. 1 and 2, respectively. The crew was heard discussing the difficulties they had closing hatch No. 2 prior to departure. At 1756, the vessel sailed with fore and aft draughts of 6.09 m and 6.86 m respectively, and, at 1830, she anchored off the dock due to the interruption of navigation on the river because of winter conditions.

At about 0750, December 5, the vessel departed Sorel anchorage for Darrow, Louisiana. The heavy ice on the river restricted sailing to the daylight period only. The "JOHANNA B" called at Quebec City from 1752, December 5, to 0611, December 6, for this reason before continuing her voyage to sea.

The voyage between Quebec City and Les Escoumins was conducted by 2 pilots, who noted that the navigation equipment as well as the main engine and its auxiliary apparatus were operating in a satisfactory manner. The gyro compass showed an error of 1°-2° low. It was noted that tarpaulins were in place on the hatch pontoons. The weather forecast report by the Quebec Weather Centre, broadcast continually on VHF channel 21B which was monitored by the vessel and transcribed by one of the pilots for the crew, mentioned a gale and freezing spray warning. However, the 1600 weather forecast issued by the Atlantic Weather Centre upgraded the 'gale warning' to storm warning for the Gulf of St. Lawrence. The speed through the water of the vessel was estimated at approximately 10 knots. The pilots disembarked at Les Escoumins at 1840 and all seemed normal aboard.

At 0838 December 7, the vessel reported, as required, to the Les Escoumins VTS Centre that she had crossed longitude 66° W. An ETA of 1200 on December 8 was filed for the next VTS calling-in-point in the Cabot Strait.

Between 2122 and 2132, several radiotelegraph calls on the frequency of 500 kHz were made by the vessel to the Sydney Canadian Coast Guard Radio Station (CGRS), but since these were not prefixed as urgent communications, they were unanswered.

At 2129, a Canadian Forces Buffalo 453 aircraft, which was assisting the "CAPITAINE TORRES" in distress 34 miles NW of Cape North, Nova Scotia, intercepted a call from "JOHANNA B". The latter reported that the position of the vessel at 2000 was 46 miles SW of Heath Point, Anticosti Island, in 48°27'N, 62°20'W

and that a course of 110°(G) was being steered. The "JOHANNA B" was asked to communicate with the Sydney CGRS on the MF frequency, 2182 kHz, to provide additional information.

At 2138, the vessel reported that the tarpaulins over hatch No. 2 had been "pulled up", that she was taking water on deck and there was 1 m of water in the hold due to the resultant downflooding. An attempt was being made to pump out this water with the vessel's pumps. A crew member was sent to assess the situation up close.

There was following wind, westerly force 8-9 (34 kn - 47 kn) and the vessel ran before the wind with the seas from astern.

At 2150, the vessel was in 48°25'N and 62°15'W. Two minutes later, the Halifax Rescue Co-ordination Centre (RCC) recommended, via CGRS, to reroute the vessel towards Anticosti Island in order to shelter her from the wind. The water level had risen to 3 m in the holds. The ship advised that a submersible pump had been added in order to cope with the ingress of water. As it seemed too dangerous to turn about, a change in heading to 125°(G) was carried out.

At 2205, the CGRS recommended that "JOHANNA B" make a distress call, but the vessel preferred to maintain radio contact with the CGRS. One of the pumps then failed. (It seems that one of the pumps had already failed; there was now only one pump operating at 2207). A proposal was made to airlift pumps; that offer was immediately accepted.

Whilst steering on a new heading, it was realized that the downflooding was increasing and, at 2214, the vessel resumed the initial heading at 110°(G). The water level was still rising and the "JOHANNA B" issued a "MAYDAY". The CGRS reported that the Buffalo 453 had been redirected toward the vessel and an ETA of 2242 was calculated for the fixed wing aircraft.

At 2221, an international radiotelephone alarm signal was heard, followed at 2224 by the relaying of the distress message broadcast by the Sydney CGRS. A last message received from the vessel on the frequency of 2182 kHz, at 2225, stated the master's concern regarding the hatch pontoons which were "tending to come free" from the coamings.

Since 2223, the "JOHANNA B" had resumed communication with the Buffalo 453 on channel 16 (VHF-FM). At 2233, it was reported that the water level in the hold reached the hatch and a few minutes later, i.e., at 2235, "JOHANNA B" reported the beginning of flooding in the accomodation. Suddenly, radio communication ceased; at that time the SAR aircraft Buffalo 453, was only 16 miles from the rendez-vous position.

At 2247, the Buffalo 453 arrived at the scene. Channel 16 (VHF-FM) calls transmitted by the aircraft received no reply. An expanding square search was initiated but the rescue operation was hindered by a wind calculated at 310° and 65 kn, and by icing and spray. Consequently, it was recommended that the helicopters not be called out. Due to the violent turbulence, the visual air search was forced to be discontinued but the aircraft remained on site and launched illuminating flares.

The first vessel, the "CONTI FORTUNE", arrived on scene at 0045, December 8 and took part in the search operation until 0628. The aerial search had been suspended for a few hours on account of the weather.

At 0638, the description of the objects sought was revised to include liferafts and persons in the water. Various marine and air units were mobilized but the search remained unsuccessful.

At 1439 December 9, the Buffalo 459 sighted a capsized lifeboat in 47°19'N and 60°31'W, but it could not remain on scene because its fuel was running low. CCGS "SIR WILFRED GRENFELL" was dispatched to the site but was unable to resight the craft. (See Analysis 16).

At 0639, December 10, the "ESSO PALM BEACH" spotted a lifeboat in 47°13'N and 59°56'W. The CCGS "SIR WILFRED GRENFELL" was requested to investigate the sighting and, at 1115, she located and identified the lifeboat as belonging to the "JOHANNA B".

Strong winds, freezing spray, seas over 10 m and a low (clouds) ceiling which continued through the three days of the search, reduced visibility and hindered the search and rescue operation. It was determined that under these weather and sea conditions, survival time was limited and, at 1100, authorization to reduce the search was issued.

On December 11, the CCGS "EARL GREY" and "MARY HICHENS" remained in the area to search for bodies and debris until nightfall, when the search and rescue operation was placed on reduced status. To date no bodies have been found.

Analysis

1. History of the Vessel

From 1982 to 1985, the Sanyo Shipyard Co. Ltd built the following series of 7 sister ships:

Ship-yard No.	Name	Year of construc-tion	Official Number	Call Sign
1007	MONTAUK EGRET	1985. 5	16105-YJ	3EXU3
1001	MONTAUK CORMORANT	1985. 1	14051-KJ	3EOR3
855	MONTAUK HERON	1983. 9	11972-KJ	3FAF2
838	MONTAUK GANNET	1983. 4	11652-KJ	3END2
836	MONTAUK KITTIWAKE	1982. 12	11366-PEXT-1	3ELD2
835	MONTAUK PEREGRINE	1982. 9	11273-PEXT-2	3EZX
833	MONTAUK OSPREY	1982. 7	11019-PEXT-3	3EGJ

While under construction, the "MONTAUK GANNET" ("JOHANNA B") was under the supervision of the Nippon Kaiji Kyokai (NKK) Classification Society. According to Lloyd's Register of Shipping, at the time of the casualty, the 7 vessels were still in service.

2. Description of Vessel

The "JOHANNA B" was a cargo vessel with 2 holds, each closed by steel pontoons and covered by tarpaulins that were secured by means of battens and wedges. The vessel could be loaded by derricks mounted forward of the accommodation and on a deckhouse located between the 2 hatches. The engine-room and the accommodation were aft (see Annex I).

3. Certificates

The vessel had been issued certificates by the classification societies Nippon Kaiji Kyokai, from her launching up to the change of owner and, then by Bureau Veritas, from April 17, 1987 up to the time of the casualty, respectively.

Permanent Registration Certificate International (Panama)	Issued November 17, 1987, valid until November 16, 1991.
International Load Line Certificate	Issued in Paris, December 18, 1987, valid until May 6, 1992.
Cargo Ship Safety Construction Certificate	Issued in Paris, December 18, 1987, valid until May 3, 1991.
Cargo Ship Safety Equipment Certificate	Issued in Paris, September 6, 1989, valid until May 3, 1991.

Cargo Ship Safety Radiotelegraphy Certificate	Issued in Paris, September 6, 1989, valid until May 3, 1990.

Ever since the vessel had been classified with the Bureau Veritas Classification Society, no special reconstruction had been undertaken and no major design defects had been found or reported. The last annual inspections were effected March 28, 1989 at Port-au-Prince, Haiti, and the last dry docking was carried out from May 31 to October 6, 1989, in New Orleans, following a grounding which, according to the records, occurred April 8, 1989, at Cape-Haïtien, Haiti. During that dry docking, damage to the bottom plating in way of the double bottom was repaired by replacing some plating and the associated internal supports.

According to the classification society, no modification had been made since that docking, and no classification restriction had been imposed upon the vessel.

4. Note of Protest

On November 25, 1989, having sailed from Savannah, Georgia, the vessel arrived at Trois-Rivières with a cargo of 4,056.79 tonnes of koalin (china clay). Between November 20 and 23, 1989, the vessel had sailed through rough weather along the U.S. eastern seaboard and fearing possible damage to the vessel and/or her cargo, the master noted protest before a public notary at Trois-Rivières on November 25, 1989. No known damage was reported following that incident.

5. Navigation Equipment

The tuning of the radars on all radar ranges had to be readjusted by a shore technician at Trois-Rivières as the repairs carried out in Savannah by shore technician had not resolved the problem. The pilots who had the conduct of the vessel after Trois-Rivières reported that these radars could lose targets on the 3 miles radar range. There was no other report to indicate malfunction of any other navigational equipment.

6. Hold Survey

On December 2, 1989, while the vessel was waiting for a berth off Sorel, an evaluation of the condition of the holds was carried out by an independent firm of surveyors for the shipper and the charterer. The condition of the vessel was reported to be good for her age. The bilges (wells) were dry although ice was present. The well covers were not fitted in

place; it was recommended to the mate that upon the covers being replaced, they be kept in position with adhesive tape or cement. The tank tops were dry but dusty.

7. Cargo

The Canadian Code of Safe Practice for Solid Bulk Cargoes based on the International Maritime Organization (IMO) Code cautions mariners that (a) improper distribution of loading can greatly stress either the structure locally under the load or the entire hull and (b) the importance of trimming can never be overstressed as an effective means of reducing the possibility of cargo shifting; more so in vessels 100m or less in length. The "JOHANNA B" was 91.6m long.

Pig iron, which has an approximate stowage factor of 0.30 m^3/tonne, is a high density low volume cargo and must therefore be well distributed longitudinally in order to avoid excessive stress to the vessel.

Pig iron consists of high-carbon iron and the ingots usually have the following dimensions : 80 mm x 90 mm x 550 mm. The Code mentions an approximate value of 36° for the angle of repose but it does not prescribe any special recommendation for this cargo. The iron ingots loaded had an average size of 60 mm x 110 mm x 270 mm and the angle of repose noted at the foundry was 45°.

8. Loading

Each load of pig iron, was loaded aboard dump trucks, weighed then transferred into the bucket of the crane loading the vessel. Initially, the pig iron were dumped less than one metre from the tank top until a cushion was created. Subsequently, the bucket was emptied from a height of at the most 3 m from the surface of the cargo. It was reported that the large area of the square of the hatch relative to that of the hold, provided access to the entire tank top in each hold, thus facilitating level loading and reducing the possibility of shifting

Upon arrival at Sorel, the master submitted a loading plan for 4,557 tonnes of pig iron, of which 1,657 tonnes and 2,900 tonnes were to be loaded in holds No. 1 and 2, respectively. Her draught fore and aft was 0.21 m and 3.81 m, respectively.

A telex sent November 22, 1989 by the owner contained the following recommendations to the master:

- load 4,700 - 4,800 tonnes of pig iron, taking into

account the winter load lines;

- ensure that the holds are swept;

- ensure that the first layer of pig iron is loaded carefully onto the tank top in order to avoid damage to the holds;

- ensure that the cargo is levelled; and

- do not load or unload liquid ballast without the charterer's consent.

It was reported that the recommendations regarding the preparation of the holds and the loading procedures were followed. The vessel sailed with a load of 1,891.56 tonnes and 2,720.25 tonnes in holds No. 1 and 2, respectively. As such, the stowage of cargo is not considered a causal factor which initiated the casualty.

9. **Hatches**

Closing Arrangement

Being a Panamanian-registered vessel, the "JOHANNA B" was required to comply with the International Maritime Organization's International Convention on Load Lines, 1966, to which Panama is a signatory.

To maintain the watertight integrity of the holds, the hatch closing arrangement aboard the "JOHANNA B" comprised steel pontoon covers positioned athwartships in the hatchways. Each pontoon rested on a steel lip 115 mm (4 1/2") wide at the inner sides of the coamings; there being no central support. The pontoons were covered with 2 tarpaulins per hatch each completely covering the hatch and were secured watertight by means of steel battens and wooden wedges.

Additionally, under the heading Security of Hatchway Covers the requirement to secure hatchway covers is contained in Regulation 15 (13) of the abovementioned Convention which states, in part:

> For all hatchways ..., steel bars or other equivalent means shall be provided in order efficiently and independently to secure each section of hatchway covers after the tarpaulins are battened down. Hatchway covers of more than 1.5 meters (4.9 feet) in length shall be secured by at least two such securing appliances.

The Classification Society, Bureau Veritas (BV) follows International Convention on Load Lines, 1966 and the interpretations of the International Association of Classification Societies (IACS). However, in reply to specific questions about the securing arrangements aboard the "JOHANNA B", the BV made no reference to the individual securing of each hatch pontoon. (See subsection on hatch pontoon locking bars).

Closing of Hatches

At Trois-Rivières, snow and ice had slowed down the hatch opening operation each morning and a crane had been used to remove the tarpaulins. The master, in a cable to the owners indicated that the vessel had experienced difficulties in opening hatches on November 28, 1989 due to continuous rain/snow/freezing rain. The harsher handling of the tarpaulins may have caused some damage; however; there is no evidence to indicate that damaged tarpaulin(s) had been used to batten down No. 2 hatch prior to the vessel proceeding to sea. Reportedly, each hold was covered with 2 tarpaulins; however the owner confirmed that the vessel was provided with 4 tarpaulins per hatch.

On December 3, 1989, the loading of ingots was completed at 1600. The crew were engaged in closing and battening down of hatches from 1600 to 1756 before leaving the berth. It was reported that difficulty was experienced by the crew in closing No. 2 hatch but no explanation was provided. As cold weather associated with snow/freezing rain persisted throughout the vessel's stay in Canadian ports, some snow and/or freezing rain could have deposited and accumulated on the edges of the pontoons and also on the lips of the hatch coaming where the pontoons rested. Hence, if thorough cleaning including de-icing of the lip/coaming edges/pontoon edges had not been carried out, difficulties could have been experienced in closing of the hatches.

Also, under the extreme cold weather conditions that persisted, the tarpaulins would tend to become stiff and consequently their handling becomes difficult. Thus had the tarpaulin not been de-iced at the discharge port of Trois-Rivières and the loading port of Sorel, difficulties could have been experienced with the tarpaulins used to cover the hatch No.2.

Both of the abovementioned being consistent with the difficulties reportedly experienced by the vessel at Sorel. Further, had ice or snow been entrapped within the borders of the tarpaulins when they were folded along the coaming before the battens and wedges were in position, it is probable that

under the continuous action of the waves breaking on main deck in conjunction with the vibration that could be experienced as the vessel worked in the prevailing sea conditions, that the wedges could have worked loose leading to the dislodgement of wedges and (side) battens and consequently the 'folding back' of the tarpaulins. The master's unfamiliarity with the northern winter climate conditions was highlighted to the pilot when he mentioned that his knowledge of navigation in ice was limited. Prudence dictates that the crew familiarize themselves with changes in the vessel's operating conditions with changes in climatic conditions.

Hatch pontoon locking bars

According to the then Managing Agents, the "JOHANNA B" was provided with locking bar arrangements but their number is unknown. The locking bars when properly used are intended to prevent the dislodging of hatch pontoons from the coaming.

At 2225, December 7, the "JOHANNA B" in a radio communication with Sydney CGRS made the following remarks:

> "Some of my hatch (button) is already cut also I'm afraid that my pontoon cover will be going out because now some of the button is already slacking over".

Note: Symbols in the transcriptions indicate the following:

( ) Questionable Text
... Pause

From this, it would appear that whatever means, if any, which had been used to secure the pontoons in position prior to her departure from Sorel were such that it could allow the pontoon(s) to dislodge. The word 'button' is assumed to mean either the steel 'batten' used along the edge of the tarpaulin which, together with the wedges, secures the tarpaulins or the locking bars on top of the hatches securing each pontoon and the word 'cut' is assumed to mean snapping/parting.

The strength of any component is only as good as its weakest link which, in the case of locking bars is normally the nut/bolt arrangement used to secure the two halves of the locking bars. There is no regulatory requirement which specifies the type of nut/bolt to be used nor is there a requirement for provision to ensure that the nuts cannot work loose. Generally the nuts/bolts used are made of steel; they are, therefore subjected to corrosion and the wastage resulting therefrom could substantially reduce their strength.

It is therefore necessary that periodic routine inspection of the nut/bolts be carried out by the ship's complement and when signs of wastage are evident, they be replaced. The sinking of the vessel precluded her examination and consequently the condition of the nuts/bolts used cannot be ascertained. Nonethe-less, at 2225 the master indicated that his hatch closing arrangements had already parted/snapped and that he was afraid that his pontoon may dislodge. Thus, the possibility of the nut/bolt, amongst other associated, failures cannot be ruled out.

Uncovering of tarpaulins

Hatch tarpaulins properly secured seldom come loose. In a radiotelephone communication between the CGRS/SAR aircraft and the "JOHANNA B" at 2238, the latter stated:

> ... we still are pumping out but still ah pumping out ah, because our tarpaulin is out of order. Our ah, tarpaulin is ah, already (pulled) out and water's spraying on deck. It still is ah, directing going inside the hatch number two...
>
> later at 2239...
>
> ...because the water is only came from the hatch (with our) tarpaulin is ah fully turned out in hatch No. two...

If the hatch tarpaulins/pontoons were covered with locking bars and nets, it is difficult to understand how the tarpaulins could be "fully turned out" (interpretation - fully uncovered). The nets holding down the tarpaulins have as their primary purpose to constrain them should the tarpaulin, for any reason, be damaged. As the vessel was equipped with 4 tarpaulins per hatch, it is unlikely that one or more damaged tarpaulin(s), either before or during securing, would have been used. As the vessel has experienced difficulties in closing hatch No.2 due to ice/snow/freezing rain during the vessel's stay in Canadian Ports, and that the tarpaulin(s) was (were) probably stiff, it would be necessary and in keeping with good seamanship practice that during the passage the securing arrangement be inspected routinely and wedges tightened to ensure that any slack resulting from the working of the vessel in a seaway, or the thawing of ice/snow is picked up.

Sister Ships - hatch closing arrangement

To better appreciate similar hatch closing arrangements of the

"JOHANNA B", two sister ships, the "GUNVOR" and the "SECIL CONGO" were visited in Mobile, Alabama and Parsboro, N.S.

On April 4, 1991, thirteen steel pontoons, similar to those aboard the "JOHANNA B", were placed athwartships in the hatchways of No. 2 hold aboard the "SECIL CONGO". Each pontoon is approximately 1.93 m long and rests on steel lip 115 mm wide at the inner sides of the coamings; there is no central support. When the hatches are closed and all pontoons are in position, they provide a flat surface. At the time of inspection, the spaces between the pontoons varied from 10 mm to 30 mm when all the pontoons were in position. It was estimated that if all the other pontoons were butted up against one side of the coaming, then the opposite end would rest on 51 mm of lip i.e. about 45% of the landing width at one end.

The pontoons were covered with 3 tarpaulins and secured along its perimeter by steel battens and wooden wedges spaced some 570 mm apart.

Aboard the "GUNVOR" on February 24, 1991, the three tarpaulins were covered with a polypropylene net which was held in position by hooks spaced 1 m apart around the periphery of the hatch coaming. According to the Managing Agents, the "JOHANNA B" was also provided with similar arrangement.

To secure the pontoons, the two vessels visited were provided with a number of 63.5 mm wide flat steel locking bars. These locking bars were placed athwartships with one end secured to each side of the coaming whilst the other ends are secured in the centre by a nut/bolt arrangement. For No.2 hatch aboard the "GUNVOR", 13 locking bars were used to secure 2 hinged, 3.6m long steel pontoons and 12 portable 1.5 m long steel pontoons whilst aboard the "SECIL CONGO", 13 locking bars were used to secure 13, 1.96 m long portable steel hatch pontoons.

Thus, the hatch securing arrangement used aboard both vessels, the "GUNVOR" and the "SECIL CONGO", as sighted, were at variance with the requirements of the International Convention on Load-Lines, 1966 in that any hatchway cover more than 1.5m in length is required to be secured by at least 2 locking bars each. The sinking of the "JOHANNA B" precluded her examination and consequently it is not known if the securing arrangement used on the final voyage of the "JOHANNA B" met the aforementioned requirements.

Securing of pontoons

The experience of a master aboard one of the sister ships

indicated that in condition of pitching and particularly of heaving and pounding, the pontoons had a tendency to move upwards from their seated positions when the vessel was at the height of her motion; consequently, there was fear the pontoons might dislodge and fall into the holds. Thus, there is a need to independently and properly secure each pontoon in accordance with regulatory requirements.

10. Previous loading

On June 26, 1988, the "JOHANNA B" had sailed from Sorel with a similar cargo of pig iron for the United States. The voyage was completed without incident.

11. Weather

Harsh Environmental conditions off Atlantic Canada

In winter, rapidly intensifying storms (or bombs as they are often called) form off Cape Hatteras with a frequency of about one every three days and race rapidly Northeastward. Associated with these storms, winds of 60 knots are common, winds of 80 knots are not unusual and extremes of over 100 knots can be expected along with 30 m wave heights, freezing spray, frequent sea ice, and dense fog limiting visibility to under 1 km about 45 percent of the time. Further, about 20 percent of tropical storms pass through or close to the east coast marine areas. The Canadian Hydrographic Service publication Sailing Directions, Gulf and St. Lawrence River States in part:

> Gulf of St. Lawrence - Winds - The Canadian Atlantic Provinces and the Gulf of St. Lawrence together constitute a region through which many cyclonic disturbances pass in the course of the year, ... Many of these are either in a process of intensification or have already reached maturity; these will produce gale to storm force winds which may persist for many hours. In some cases, the storm will decelerate or even stall in the vicinity, and at such times gale force winds have been known to persist for several days with little change in either strength or direction....
>
> The gale to storm force winds associated with the major disturbances .... may be accompanied by squalls of a more severe nature. It appears to be a reasonable safe rule to assume that peak wind speeds in squalls may be up to

> half as great again as the average wind speed. Storm force winds (Beaufort force 10; i.e., 48 knots or more) will average about 2 to 5 per cent of the time from late November until early April. Winds of close to 80 knots have been recorded on the Iles de la Madeleine in mid-winter....

Strong winds from a N to NW direction in the colder months are frequently responsible for freezing spray conditions.

Atmospheric Environment Service (AES) Mandate

The AES of Environment Canada (EC) is responsible for recording past and present weather conditions and predicting future weather conditions. Their primary objective is to ensure that Canada has adequate information on the atmosphere, ice and sea state for the safety of life, the security of property, the greater efficiency of economic activities and the maintenance and enhancement of environmental quality.

Weather and Passage Planning

As part of a vessel's passage planning, consideration has to be given to the climatological data affecting the areas, to be transited followed by periodic monitoring of the weather report forecasts to ensure safety of the vessel and her crew.

Weatheradio Canada is a public service which transmits up-to-the-minute weather information over VHF-FM Radio, 24 hours a day, 7 days a week. The information is also broadcast as a bulletin by CGRS and commercial radio stations. When forecast conditions change, the weather centre will issue an update by way of special bulletins which are broadcast through marine radio stations.

The Weather Centres broadcast marine weather 4 times a day. The forecast is for a 2 day period and gives an overview of the general condition and the winds for the third day. The forecast areas number 57 to 64, covering the St. Lawrence River from Montreal to Gaspé are covered by the Quebec Weather Centre and those numbered 1 to 19 and the East Coast are covered by the Atlantic Weather Centre (see annex II).

On her passage from Sorel to Darrow, the vessel was required to transit areas of the St. Lawrence River, Gulf of St. Lawrence and the Atlantic Coast. However, as all lives were lost, it is not known what practice aboard the "JOHANNA B" was in place respecting monitoring of the forecast weather.

The vessel was fitted with a weather fax receiver but its operational status is unknown.

Synopsis Analysis

Weather forecasts issued by the Atmospheric Environment Service department of Environment Canada during the 2 days prior to the vessel's arrival at Escoumins on Wednesday, December 6, indicated that gales and freezing spray could be expected for all of the 500 mile passage through the Gulf of St. Lawrence and Cabot Strait.

The 0300, December 6, 1989 marine weather forecast issued by Environment Canada comprised the following:

> Tadoussac to Pointe-des-Monts:
>
> Warning: Freezing spray.
> Wind: W-SW 20-30 kn becoming S-SW 10-20 kn by mid-day.
> Precipitation: Light snow.
>
> Pointe-des-Monts to Anticosti
>
> Warning: Freezing spray and gales this morning
> Wind: W 25-35 with few gusts of up to 45 early this morning near south shore, decreasing 15-25 by mid-day
> Precipitation: Flurries

The synopsis contained in the same forecast read as follows:

> Synopsis at 01.00 AM EST and forecasts positions by 07.00 PM EST. A weak ridge of high pressure in a north-south line across Trois-Rivières is moving eastward to lie across Anticosti Island by the evening. A frontal trough stretching from James Bay to Lake Michigan will lie from Lac St. Jean to Trois-Rivières this evening. Ahead of the ridge are winds strong to gale force west to southwesterly that become light and variable then moderate south to southwesterly behind it ahead of the trough.

On December 6, 1989 a low pressure was observed moving eastward from Ontario to Quebec. There was strong indication that this low pressure system or another associated system would deepen quickly or explosively while passing over the Gulf of St. Lawrence. Following this development, the Atlantic Weather Centre issued a "storm warning" predicting NW winds of up to 55 kn for the Anticosti area in the 1600 December 6 weather report. A gale and freezing spray warning

had already been in effect for 48 hours. That morning towards 0611, the "JOHANNA B" departed Quebec, her last port of call prior to her sinking.

The 1700 weather forecast transmitted by the Atlantic Weather Centre upgraded the 'Gale Warnings' to 'Storm Warnings' and predicted NW winds of 40-50 kn for Thursday morning December 7 for the Gulf-Madeleine area.

At 1844, the vessel sailed from the Les Escoumins pilotage station. Before disembarking the vessel, one of the pilots transcribed the following 1630 weather forecast report issued by the Quebec Weather Centre:

Tadoussac to Pointe-des-Monts:

Warning: Gale and freezing spray.
Wind: SW 10-15 kn becoming W-SW this evening then NW 20-35 kn. Thursday morning (December 7)
Precipitation: Snow - snow flurries.

Pointe-des-Monts to Anticosti:

Warning: Gale and freezing spray.
Wind: W-SW 10-20 kn this evening becoming SW 10-15 kn then 20-40 kn.
Visibility: Good.

Thus the vessel was aware of the 'gale and freezing spray warning' and continued on her passage.

The first broadcast of the 'storm warning' by the Quebec Weather Centre for Pointe-des-Monts - Anticosti area was at 0300, December 7, some 10 hours after the "JOHANNA B" departed the pilot station and some 12 hours after the "storm" warning was first issued by the Atlantic Weather Centre.

At 1130, December 7, the "JOHANNA B" was by then off the Gaspé shore, probably off Cap-de-la-Madeleine. The weather forecast for the Gulf predicted winds of up to 60 kn for the afternoon.

The "JOHANNA B" did not seek shelter but continued on her passage without significant reduction in speed into the path of the forecast storm areas. Some 24 hours after the first storm warning, vessels sailing in the Gulf of St. Lawrence encountered the predicted storm-force winds. Barometer pressure dropped rapidly and considerably and the low pressure stalled east of Newfoundland. This resulted in force 10 (48-55 kn) high winds for 3 days. This phenomena is infrequent because most of the low pressures stall over the Labrador Sea, some 500 miles North (see Annex III).

Approx. 30 hours elapsed between the first storm warning i.e. 1600 hours, December 6, and the first request for assistance by the "JOHANNA B", received around 2129, December 7.

Winds experienced by the "JOHANNA B"

The wind conditions experienced by the vessel were consistent with that forecast for the area and around the time of the casualty, the winds, as experienced by SAR units, were 310° at 65 kn in the vicinity of the vessel's last known position.

The 2806 gross tons, "JOHANNA B" was fully laden with cargo and had a low freeboard of 1.51m. Thus, in the storm force winds that had been forecast, it would be prudent to expect the vessel to frequently ship heavy green seas on deck.

Sea State

Forecasts are issued by the Weather Centres twice a day and are usually in effect for approximately thirty hours. The distance between the trough and the crest of a wave is the height of the wave. The main factors governing the height and the velocity of waves are the speed and direction of the wind, its persistence in a given direction or at a given speed, the fetch (distance to the shore in the direction from where the wind is coming) and the depth of water. In Oceanography, the statistical concept of "significant height" is used. This height represents fairly closely the average height of the waves noted aboard ships. The maximum height of the waves is equivalent to approximately 1.8 times the significant height. It is up to mariners to note that the height of the waves may vary considerably in coastal waters and/or in waters less than 50 m deep; this caution is also broadcast along with the sea state forecast.

The report at 1900, Wednesday, December 6, advised mariners that the 2 m seas would increase to 3 m during the evening, reaching 4 m Thursday, December 7, in the Gulf of St. Lawrence and Cabot Strait. The sea state forecasts did not reflect those experienced; the sea developed faster than expected and reportedly reached 10 m. South of Heath Point on Anticosti Island, in the vicinity of the last known position of the "JOHANNA B", confused seas reaching 12 m were reported.

12. Speed of Vessel

The stability booklet mentions a service speed of 11.0 kn. The master reported to the pilots assigned the conduct of the vessel between Quebec City and Les Escoumins that the service speed was 10.0-10.5 kn. One hundred and twenty miles separate

Quebec City and Les Escoumins pilotage stations. The vessel covered that distance in 12 hours and 22 minutes at a speed over the ground of 9.71 kn in ice and prevailing weather and tidal conditions.

From 0355 to 0838 on December 7, the vessel covered the distance of 52 miles between Pointe-des-Monts and the 66° W meridian at an average speed of 10.9 kn. Reporting at longitude 66° W to the Les Escoumins VTM Centre, the vessel gave an ETA of 1200, December 8 for Cabot Strait. In order to cover that 270 miles distance, the vessel would have to maintain a speed of approximately 10 kn.

13. Schedule

At an average speed of 10 kn, the vessel should have been off Gaspé in the evening of December 7, south of Heath Point, Anticosti Island around midnight, and NE of the Magdalene Islands during the morning of December 8 (see Annex IV). At the time of the casualty, the vessel was slightly ahead of calculated schedule; in other words, the vessel had maintained her normal service speed.

14. Radio communication

The last contact with the vessel was by radio in the evening of December 7 on VHF-FM and MF-FM.

Radiotelegraphy

The first calls were radiotelegraphy calls on the 500 kHz frequency. From 2122 to 2125, five general calls were launched by the vessel to Sydney CGRS, which did not acknowledge receipt. Between 2127 and 2132, six other calls addressed to the same station but more urgent in nature (including the word "rush") received no response either. The calls were not addressed to all stations and were not emergency calls; therefore, they could not supersede the traffic already being worked by the station. However, they had also been received by the Rivière-au-Renard CGRS which, at 2133, attempted to establish contact with the "JOHANNA B". The vessel did not acknowledge receipt on the 500 kHz frequency.

Radiotelephony

Annex V shows the network of main Canadian Coast Guard Radio Stations and their long-range facilities covering the Gulf of St. Lawrence. Given the limited range of the VHF-FM radiotelephones and the severe weather conditions, the

broadcasts of the "JOHANNA B" on channel 16 as received by the SAR aircraft were not received either by the Rivière-au-Renard CGRS(VCG) or by the Cap-aux-Meules CGRS(VCN). A Buffalo aircraft, unit 453, which had been summoned from the CFB Summerside, P.E.I., entered into communication with the "JOHANNA B". Since the transmissions of the Buffalo 453 were broadcast at high altitude, they were received by the earth stations. Therefore, only the conversation of the aircraft on channel 16 was recorded.

The range of MF radiotelephones is greater than that of VHF-FM and the transmissions of the "JOHANNA B" on 2182 the frequency addressed to the Sydney CGRS for the Halifax Rescue Co-ordination Centre were received by all surrounding CGRS.

The Buffalo 453 reported to CGRS Sydney that at 2235, the "JOHANNA B" reported that water was coming into her accommodation area. At 2236, the Buffalo 453 attempted to raise "JOHANNA B" on VHF channel 16 but to no avail. At 2237, the Buffalo 453 informed CGRS that it had lost radio contact with the distressed vessel. A listening watch was maintained on the 3 International Distress Safety and Calling frequencies, i.e. 156.8 MHz, 2182 kHz and 500 kHz but no further radio messages were received from the "JOHANNA B".

Radio Communication Equipment

The MF 2182 kHz radiotelephone equipment aboard the "JOHANNA B" was positioned in the radio room located aft of the accommodation one deck below the bridge. It is known that all R/T distress messages were made by the master himself. Thus, during the emergency, the master had to proceed below-deck to communicate with the CGRS. Because of this set-up, the master could not monitor visually the deck and had to leave the bridge in the hands of his subordinates during critical times.

15. Distress Communication

At 2150, December 7, 1989, RCC Halifax through CGRS Sydney recommended to the "JOHANNA B" to transmit a distress call but the latter preferred to maintain radio contact instead. When it was realized that the control over the downflooding was lost at 2214, a "MAYDAY" was declared by the vessel. Following this broadcast a SAR air unit was diverted towards the vessel.

Declaring a distress call

Chapter V, Regulation 9 of the International Maritime Organization's International Convention for the Safety of Life at Sea (SOLAS) emphasizes that international distress signal

be used only for the purpose of indicating that a ship or an aircraft is in distress.

The decision when to declare distress rests primarily with the master. As such, he is guided in his decision by on-scene appraisal of the situation taking into consideration, amongst others, the capabilities and limitations of his vessel and his crew.

In this case, the reason for the master not declaring a distress earlier in unknown. However, experience has shown that masters of ships are often hesitant to declare distress at an early stage due to a reluctance to initiate a massive SAR mission and costly SAR operation or the failure to fully appreciate that a situation on board may culminate in a disaster. Instances are on record whereby failure to declare timely distress has resulted in loss of life and property.

Only in cases where contact is lost with the vessel, can a person with vested interest, other than a master, declare a "MAYDAY" on the vessel's behalf.

Distress Call and SAR

Upon receiving a request for immediate assistance or a report of an onboard situation where potential exists for its deterioration which may necessitate eventual assistance, the Rescue Co-ordination Centre (RCC) Marine Controller evaluates the situation. Consideration is then given to the request for assistance and based on the resources at hand in conjunction with the urgency of the situation tasks primary, secondary and/or auxiliary SAR units, Marine and/or air, as necessary to proceed to the assistance of the distressed vessel. However, when a vessel declares a distress, all vessels are obliged under Chapter IV Regulations 10 of the SOLAS Convention to proceed to and assist a vessel in distress. Furthermore, Article 385(2) of the Canada Shipping Act (1990) also empowers Rescue Co-ordination Centre to task any vessel to assist another vessel but only in a distress situation. Thus prudence dictates that when a situation warrants, a master err on the side of safety by declaring a distress earlier rather than later. This enables RCC to task and seek appropriate assistance from all vessels and aircrafts in the area thereby increasing the possibilities of timely assistance reaching the distressed vessel. Furthermore, should there be a subsequent improvement in the situation that no longer warrants assistance, the distress call can always be cancelled.

In this case, some 64 minutes of time had elapsed from the time "JOHANNA B" first communicated with Buffalo 453 at 2129

seeking assistance and the time when communications were lost with her at 2233, and the vessel initially declared distress at 2204 only some 29 minutes prior to her loosing contact with SAR components. It should be noted that the "CONTI FORTUNE" was some 2 hrs steaming time away from the "JOHANNA B" when contact was lost with the distressed vessel.

16. Search and Rescue

On December 7, 1989:

- At 2138, RCC Halifax was informed that No.2 hatch tarpaulins aboard the "JOHANNA B" had been damaged. At 2150, the "JOHANNA B" was advised to take refuge south of Anticosti Island and, at 2214, an aircraft, Buffalo 453, which was bringing assistance to the "CAPITAINE TORRES" was diverted towards the vessel. When it arrived at the last known position (LKP) at 2247, the Buffalo 453 began an expanded square search pattern (1 mile increment). Due to the adverse weather, the aircraft had to gain altitude thus limiting the visual search. A helicopter standing by at CFB Summerside was stood down due to the weather. At 2300, the MRSC Quebec mobilized the CCGS "SIMON FRASER" and the DFO vessel "LADY HAMMOND". An Aurora aircraft from CFB Greenwood, Nova Scotia, was tasked but due to weather conditions the commanders of Squadron 413 at CFB Summerside decided not to launch the aircraft at this time. In the meantime, at 2313, the "CONTI FORTUNE" positioned 48°29'N and 62°37'W, approximately 8 mile to the west of the distressed vessel's last known position, was tasked.

On December 8:

- At 0045, the "CONTI FORTUNE" arrived on the scene (LKP). Due to icing, at 0210, the "LADY HAMMOND" returned to Chandler, Gaspé. A review of the MAYDAY RELAY message indicated that at 0638 the search object had been revised to include a liferaft and persons in the water. Towards 0700, Tracker aircraft Squadron 880 received the order not to take off because of the extreme weather conditions but to remain on standby. At 0710 CCGS "EARL GREY" was tasked. Altogether, 7 other merchant vessels transiting through the Gulf were tasked by RCC Halifax to participate in the search. Six air units also took part in the search. The weather hindered the search operations and nothing was sighted.

On December 9:

- Six air and seven surface units were tasked. The probable search area extended southward up to the Magdalene Islands and eastward to Cabot Strait. At 1439, the Buffalo 459 spotted a capsized lifeboat in 47°19'N and 60°31'W, but the aircraft had to withdraw due to low fuel. CCGS "SIR WILFRED GRENFELL" was immediately sent to the scene but nothing was found. In addition, the Buffalo 453 did an expanded square search pattern to a distance of 20 mile from the LKP, but the exercise was fruitless. The storm persisted. Visibility was estimated to be at most 0.5 mile, there were 6-9 m seas (Beaufort 10) and the temperature remained at -15° C.

On December 10:

- It was determined that the probable search area for the "JOHANNA B" now straddled that of the "CAPITAINE TORRES". Thus, the search operations directed by RCC Halifax were run in parallel for both vessels and the Cabot Strait was established as the eastern boundary of that coverage. Four marine and four air units participated in the search. At 0639, the "ESSO PALM BEACH" sighted a lifeboat in 47°13'N and 59°56'W. CCGS "SIR WILFRED GRENFELL" was requested to investigate and, at 1115, located the lifeboat in position 47°08'N and 59°47'W. The boat, half-filled with water and without any occupant was identified as part of the life-saving equipment of the "JOHANNA B", but it could not be retrieved because of the rough seas. It was noted that the 'search objects' had now 'drifted' to the Cabot Strait. An expanded square search up to 5 mile using this latter position as datum was effected but nothing was found.

  Considering that the two lifeboat sightings were found unmanned and that the crew members were exposed to weather (air temperature of minus 15° C, high winds and water temperature plus 3 to 5° C), it was determined that the possibility of finding survivors was extremely remote. In view of the large area to be swept and since the estimated survival period had elapsed, authorization to place the search on reduced status was issued by the regional SAR Commander at 1100. At 1516, the last aircraft was stood down.

On December 11:

- The last two marine units to remain in the area were the CCGS "EARL GREY" and "MARY HICHENS", which searched for bodies and debris; in the absence of any results; at nightfall, the search and rescue operation was placed on reduced status (see Annex VI).

17. **Freezing spray**

A mass of very cold (-10° to -15° C) air in the form of NW gales covered the relatively warmer (1 to 4° C) water surface of the Gulf of St. Lawrence. This temperature drop facilitated the formation of freezing spray and snow flurries, thereby reducing visibility. Visibility ranging from 0.25 to 1 mile was reported.

At the time of the casualty, vessels operating in the Gulf of St. Lawrence reported ice accretion due to freezing spray; however, the "JOHANNA B" made no mention of freezing spray in any of her recorded radio communications. Further, in view of the vessel's very large metacentric height, ice accretion, if any, would not have significantly impacted the vessel's transverse stability to have been considered a factor in this casualty. The units which took part in the search and rescue operation over the following days were hampered, at times severely, by the freezing spray.

18. **Life-saving Equipment**

Certificate

The Cargo Ship Safety Equipment Certificate issued pursuant to the provisions of the International Convention for the Safety of Life at Sea, 1960, (SOLAS), for the "JOHANNA B", indicates that the following life-saving appliances were part of the equipment at the time of the last inspection on September 6, 1989:

- an open lifeboat capable of accommodating 22 persons;
- an open motor lifeboat capable of accommodating 22 persons;
- a liferaft for which approved launching devices are not required capable of accommodating 15 persons;
- 8 lifebuoys; and
- 22 lifejackets.

The vessel was not equipped with an emergency position-indicating radio beacon (EPIRB) and she was not required to have such a device.

The Fujikura-made liferaft was lashed to the deck of the bridge aft of the starboard wing. The vessel's liferaft was fitted with a hydrostatic release device, manufactured by Sentral Co. Ltd., type C-39, model No. 57-9. The last inspection of the liferaft and of the release mechanism was on May 3, 1989, and the systems were covered by certificates issued by Neptune Supplies Inc. and Unidor Ships Service, respectively. It was reported that no modification had been made to this liferaft and release equipment since that purchase. The liferaft was not sighted during the search and rescue operation. The vessel carried a complement of 16 persons whilst the total liferaft capacity was 15.

Decision to abandon a vessel

The decision to abandon the vessel rests with the master who is responsible for the safety of his crew and takes into account the existing factors and risks, including the capabilities and limitations of the life-saving equipment. Based on the evidence, it is apparent that the master chose to stay aboard the vessel for as long as possible while awaiting assistance and the vessel remained afloat and stable, rather than risk the crew's safety to life-saving appliances in the prevalent sea and weather conditions. The extent of success of a decision to abandon the vessel earlier cannot be ascertained, however instances are on record where premature abandoning has led to loss of life while the vessel has remained safely afloat.

IMO 1983 SOLAS Amendment

The requirement to have an enclosed lifeboat, an inflatable liferaft of sufficient capacity to accommodate all crew members and the requirement for each crew member to be provided with an immersion suit or a thermal protective aid is contained in the 1983 SOLAS Amendment.

In the case of "JOHANNA B" which was constructed in April 1983, these amendments which would come into force on July 1, 1991 did not apply. However, had the lifeboat(s) and/or liferaft been replaced or additional lifeboat or liferaft were added to the vessel, the "JOHANNA B" would have been obliged to comply with the latest updated requirements. Further, the "JOHANNA B" as fitted out at the time of the casualty would have been required to comply with the immersion suit(s) and/or thermal protective aid(s) requirement no later than July 1, 1991 provided that in the opinion of the Administration these suits are deemed unnecessary due to the

vessel being constantly engaged on voyages in warm climates.

At the time of the casualty the vessel was not required to carry a float-free EPIRB. However, the IMO Resolution A660(16) adopted on October 19, 1989 recommends that Administrations encourage the early fitting of float-free satellite EPIRBs prior to August 1, 1993 the date of entry into force of the 1988 SOLAS amendments requirements for the carriage of satellite EPIRBs on ships.

It should be noted that in this instance, the vessel was not provided with either immersion suit(s) or thermal protective aid(s).

19. Stability

Reference Documentation

The vessel's basic design data and trim and stability booklet were lost when the "JOHANNA B" sank, however, the shipbuilder, Sanyo Shipyard Co. Ltd., confirmed that the sister ships mentioned in Analysis 1 share, in common, stability curves. The documentation of the "GUNVOR" ex "MONTAUK EGRET" that was used for this study permitted the determination of the hydrostatic characteristics of this vessel using a specialized software.

Conditions on arrival and departure

Using the vessel's displacement table in relation to the draught, the vessel's conditions at the time of departure and arrival from the ports of call in Canada could be compared. As ports of Trois-Rivières and Sorel are located in fresh water, thus all draughts noted at the time of arrival and departure from these ports should have corresponded to the fresh water displacement. The arrival draughts for Trois-Rivières and Sorel accordingly corresponded to the fresh water displacement. However, the condition at the time of departure from Sorel with a load of pig iron showed a difference of 2.6% between the total known weights on the vessel and her fresh water displacement. This difference is almost identical to the difference in densities of the fresh water and salt water (1000 and 1025 ie 2.5%). This observation indicates that the draughts of 5.92 m forward and 6.73 m aft given by the crew on departure from Sorel on December 3, 1989 had been corrected for salt water (see particulars of vessel).

Initial displacement

The stability on departure shows that the vessel was displacing 6330.28 tonnes in fresh water and the draughts were calculated to be 6.090m forward and 6.858m aft. It is not

known why the salt water draughts were given by the vessel to the pilots; however one explanation being that the crew may have wanted to confirm that the vessel complied with the International Load Line Convention 1966 requirements. It should also be noted that instances are on record where pilots have been given SW draughts instead of FW draughts in the St. Lawrence River between Quebec City and Montreal primarily because some of the vessels were unawares as to the limits of fresh and salt water. After due allowance for fuel and potable water consumption from Sorel to the limit of inland navigation, her sea-going freeboard of 1.475 m and loaded mean draught of 6.325 m conformed with those assigned for Winter North Atlantic operation (see Annex VII).

Volume of cargo

With respect to the positive trim of 0.52°, the longitudinal centre of gravity of cargo in each hold would have been located 630mm forward of the volumetric centre of each hold. (See Annex VIII). The cargo of 4.611.81 tonnes of pig iron was distributed as 1,891.56 tonnes in hold No.1 and 2.720.25 tonnes in hold No.2, respectively. Pig iron has a density of 7.288 tonnes/m^3 and a stowage factor of 3.188 tonnes/m^3. The pig iron therefore took up 43.74% of the volume. Considering the stowage factor, the pig iron had to take up the following volumes and average heights above the tank top:

Hold No.	Volume m^3	Height m
1	593.34	2.036
2	853.28	1.793

Seaworthiness of vessel

The last pilots who had the conduct of the vessel between Quebec City and Les Escoumins reported that "JOHANNA B" was upright, without a list, and that she did not seem tender. Calculation of the transverse and dynamic stability established that the vessel amply met the basic criteria recommended by the International Maritime Organisation (IMO). The areas under the righting arm curve (GZ) for list angles up to 30° and 40° were several times greater than the standard required by the IMO. The righting arm (GZ) was five times greater than the minimum recommended for a list angle of 30°. In addition, the metacentric height was 16.6 times greater than the minimum recommended by the IMO. In other words the vessel would have been 'stiff' and subject to a violent short roll in certain sea conditions.

Consumption

After sailing from Sorel, the "JOHANNA B" had to anchor off the loading dock and stop over in Quebec City before sailing out to sea. The movements between December 3 and 7 reduced the amount of fuel aboard the vessel. Fuel oil and diesel fuel daily consumption was estimated at 12.06 tonnes and 2.63 tonnes, respectively. The displacement of the vessel was reduced to 6,316 tonnes. The static transverse stability was slightly affected but the area under the righting arm curve (GZ) increased and thus improved the dynamic stability of the vessel. The "JOHANNA B" then had a freeboard of some 1.515 m.

Downflooding

The flooding point, in intact condition (all openings closed/no leakage calm seas), was determined to be the sill of the accommodation access door, at frame 22, on the poop deck, and the flooding angle, calculated with a positive trim of 0.52° in freshwater, was 40.05° at the start.

20. Suctions

Bilges Suctions

The suctions were connected to the main bilge manifold. The following main and auxiliary pumps could drain the holds:

Main pumps	Flow rate
General service and fire	$120m^3/hr$
Ballast and fire	$120m^3/hr$
Auxiliary pumps	
Seawater cooling	$75m^3/hr$
Drainage	$0.5m^3/hr$

The two main pumps were connected independently to the main manifold while the cooling and drainage pumps were connected to a common line prior to joining the main manifold.

Emergency Pump

As a last backup, a portable submersible pump of unknown origin and specifications had been used in the hold.

Hold No.2 was 35.1 m long and was equipped with suction in the centre and after part of the hold. The tank top extended from side to side and the suction ended in wells on either side.

21. Ingress of water

Level Reported

Around 2138, the "JOHANNA B" had reported 1 m of water in hold No.2 and, around 2156, the level of water had increased to 3 m which represented an increase of 2 m. This ingress represented a large quantity of water in a short period of some 18 minutes and indicates that the ingress was rapid. At 2233, RCC Halifax was informed by Buffalo 453 that the level of sea water in hold No.2 aboard the "JOHANNA B" had reached the hatchway; approximately one hour after the first call. At 2235, ingress of water into the accommodation was reported and radio contact was lost with "JOHANNA B".

Evaluation of ingress

A bulkwark located forward of the accommodation one deck above the main deck sheltered from the weather the scuttle hatch giving access to hold No.2 and the sounding pipes to bilge well suctions. This arrangement would facilitate the task of evaluating the ingress of water to the compartment and of using the portable pump.

Given the weather conditions under which the vessel was operating, it is difficult to understand how the soundings and/or visual estimate to determine the waterlevel in No.2 hold could be accurate.

22. Pumping arrangement

Breakdown

At 2207, the bilge pumping system aboard the "JOHANNA B" ceased functioning with the exception of the emergency submersible pump. Unfortunately the ingress persisted. However, at 2225 the master confirmed that the pontoons were still in place but was envisaging their possible loss. The bilge pumping arrangement aboard the "JOHANNA B" could not cope with the ingress of water and the breakdown of the pumping arrangement accentuated the loss of reserve buoyancy.

Presence of ice

The hold condition survey prior to the vessel's loading revealed the presence of ice in the bilge wells. As bilge lines are generally not drained, possibility exists that some water remaining in the line may have formed ice. Ice in the lines could have reduced the effectiveness when pumping No.2 hold.

23. Rapid deterioration of situation

At 2233, R453 informed CGRS that the "JOHANNA B" reported that the sea water was at the level of No. 2 hatch. Subsequently at 2235 when the "JOHANNA B" indicated that water was now coming into her accommodation, R453 was some 10 minutes flying time away from the distressed vessel. At 2236 R453 informed "JOHANNA B" that they were 5 minutes flying time away from her and immediately thereafter all radio contact with the "JOHANNA B" were lost; there being no further communication with the vessel. This would indicate that there was a sudden and drastic deterioration in the situation aboard the "JOHANNA B" in the final moments leading to her sinking.

24. Other Considerations

Consideration was given to the following factors:

(a) The possibility of cargo shifting resulting in hull damage has been discounted because of the nature of the cargo and the fact that no list had been reported by the vessel throughout the period she communicated with CGRS and SAR units.

(b) The possibility of ingress via the hold ventilation system has been discounted because of the location of the intakes which are positioned some 18m above the main deck.

(c) The hatch of hold No.2 was 26m long and 10m wide and was closed by 13 steel pontoons and tarpaulins. Assuming that the tarpaulins were lost and that the spaces between the pontoons totalled 8 cm, the areas subject to ingress of water was 8 cm x 10 m i.e. 0.8 m . By way of comparison, if such an opening were constantly immersed by shipped seas to a mean depth of 1 m, the approximate rate of ingress would have been 13,030 tonnes/hour. Alternatively, as the vessel rolled in a seaway and if hatch covers were immersed to half their breadth with about 1 m of water allowed at their outboard ends, the approximate rate of ingress would have been 4,600 tonnes/hour.

25. Impact of working conditions on job performance

Reportedly, the crew were not properly clothed and insulated for the cold Northern climate with many crew members wearing sneakers whilst working on deck in snow and prevailing cold temperatures. Persons thus attired would have been at least uncomfortable and possibly impaired due to the effects of cold and this would have had an effect on their work performance.

26. Abandoning of "JOHANNA B"

There is no evidence to indicate that the crew of the "JOHANNA B" attempted to abandon the vessel prior to her sinking. In one of the final communications with SAR aircraft at 2233, the "JOHANNA B" indicated that sea water was at the level of No. 2 hatch and that at 2235, water was finding its way into the accommodation. The rescue aircraft responded and indicated that pumps would be air-dropped, if possible; there having been no mention of abandoning the vessel. The final contact with the vessel was only seconds prior to losing all radio contact with her. Thus, the sudden and dramatic sequence of events that culminated in the vessel's sinking would have made it very difficult for the crew to safely abandon the vessel.

27. Possibility of survival

The prime considerations in determining when the vessel should be abandoned is the capabilities and the limitation of the life-saving equipment in the prevalent weather conditions. Thus, taking into account that:

- neither thermal protective aids nor immersion suits were aboard the vessel nor were they required to by SOLAS;
- the open lifeboats provide very little protection to the crew against weather;
- the vessel was not equipped with free-fall enclosed lifeboats nor were they required to by SOLAS;
- as the liferaft was manufactured prior to 1986, the stability requirements of the water ballast bags were lower than those manufactured since that date; their being no requirement to retrofit and improve existing liferafts;
- the crew were not properly clothed for the Canadian cold climatic conditions;
- the cold water temperature in conjunction with the 10 m seas and the reduction of air temperature due to the wind chill factor created by the 60 kn wind, would have drastically reduced their survival time to minimal; and the wind chill temperature at the time of loss being - 30°C, and
- the survival time for a person wearing a lifejacket was in minutes as opposed to hours if he/she was wearing an immersion suit; the immersion suits are designed such

that theoretically the individual's survival time would be limited by one's ability to sustain life without food and water while fighting against cold. In the conditions that prevailed at the time of the casualty, the main limiting factor will be the individual's ability to avoid drowning.

It would appear that even if the crew were able to successfully abandon the "JOHANNA B" into a lifeboat/liferaft wearing lifejackets, their chances of survival would have been minimal. Another vessel, the "CAPITAINE TORRES" was abandoned in the same storm and whilst some of the crew were seen alive in the liferaft by the rescue vessel, they could not be recovered in those severe weather conditions.

28. Previous Abandonment

History shows that there have been many victims, if not total loss of a crew, following abandonment of vessels during winter storms in Canadian Waters. The "GABRIELLA", the "OCEAN RANGER", the "MEKHANIK TARASOV" and more recently, in the last storm the "CAPITAINE TORRES", are examples of crew at the mercy of extreme weather. The chances of crew survival would have been improved if manned, totally enclosed, lifeboats launched clear of the vessel had been used.

Findings

On December 7, 1989, the Panamanian cargo vessel "JOHANNA B" encountered a storm in the Gulf of St. Lawrence. The sea breaking on deck folded back the tarpaulin of hatch No.2 and downflooding ensued until the vessel foundered; the precise reason for the tarpaulins becoming loose and folding back is not known. It would appear that the following factors contributed to the sinking of the vessel:

- the low pressure system deepened rapidly and stalled off the Newfoundland Coast resulting in the vessel experiencing 50-60 kn winds and 10 m seas;

- the seas rose faster and reached heights significantly greater than forecast;

- the vessel sailed into the path of the forecasted storm and shelter was not sought;

- once dislodged, the tarpaulins could not be resecured due to the prevailing weather conditions;

- the relatively low freeboard of the vessel permitted heavy seas to be shipped on deck;

- the resultant downflooding increased the vessel's trim by the stern, further reducing her freeboard;

- the bilge pumping system could not cope with the ingress of water in No.2 hold and was further exacerbated by the breakdown of pumps, and

- the ingress was rapid and continued until all reserve buoyancy was lost.

It would appear that the following factors contributed to the loss of 16 lives (all crew members):

- delay in declaring distress despite rapidly deteriorating conditions resulted in the loss of valuable time;

- the sudden and rapid loss of reserve buoyancy in the final stages of the casualty precluded safe abandoning of the vessel;

- the vessel was not equipped with suitable life-saving equipment necessary for survival in the harsh cold climate conditions;

- extreme weather hampered SAR operations and the aircraft could not reach the vessel in time, and

- the climatic conditions did not favour prolonged survival.

Other Findings

The crew had trouble in closing hatch No.2 before leaving Sorel, the cause for which is unknown.

There was presence of ice in the bilge well suction, which had not been cleared before loading.

The vessel was not equipped with an EPIRB nor was one required by regulation at that time.

The history of crew survivability when vessels are abandoned during winter storms around the Eastern Canadian Seaboard is poor.

Aboard the "GUNVOR" and the "JOHANNA B", as the MF radio(s) was/were positioned in the radio room, away from the bridge, the master, of necessity if he required to speak directly himself, in a time of emergency for a two way flow of information, would have to proceed below deck to communicate leaving the bridge in the hands of his subordinates.

This casualty emphasises the need to ensure that the hatch securing arrangements are efficient, sufficient and well maintained.

During the vessel's stay in Canadian waters, the crew were observed to be improperly clothed for the Canadian cold winter conditions.

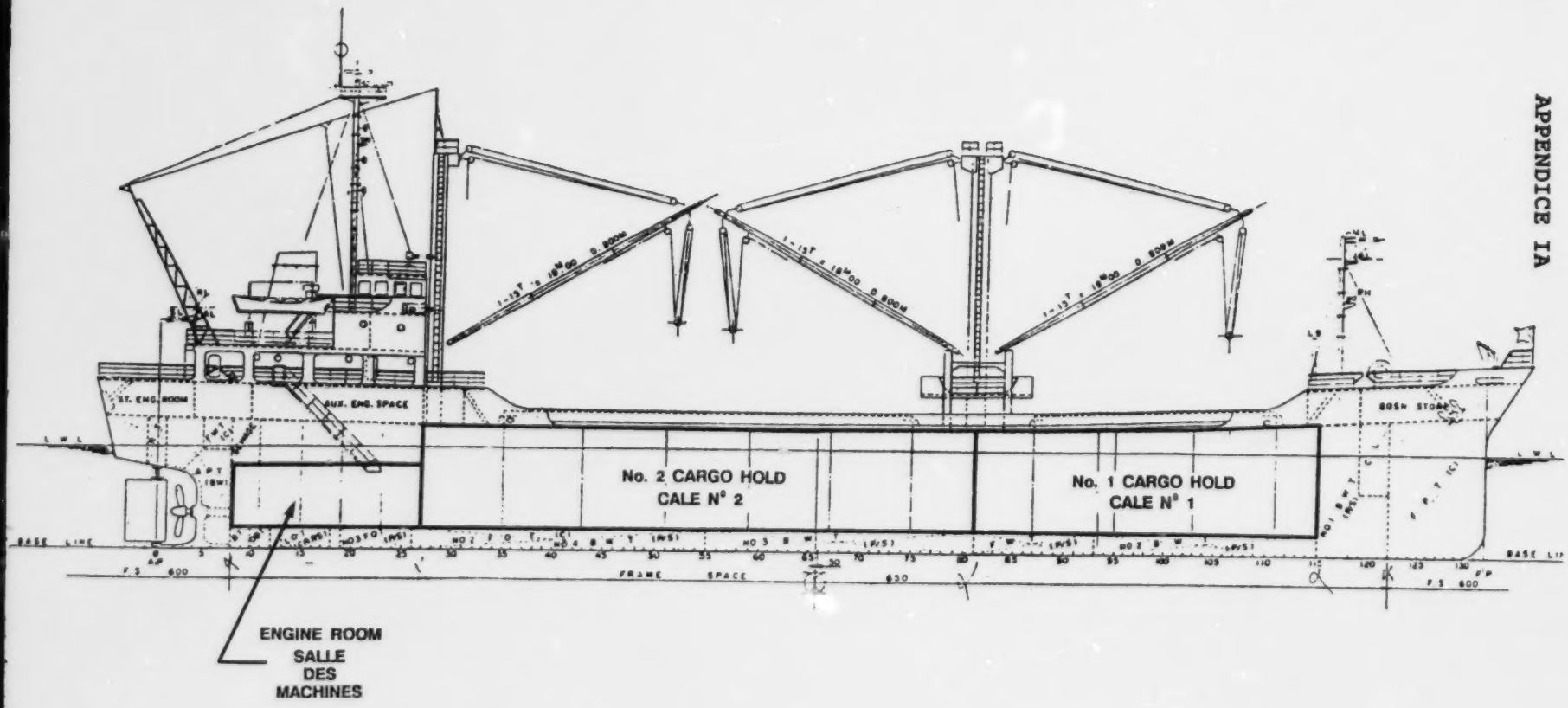
OTTAWA, ONTARIO
SEPTEMBER, 1991

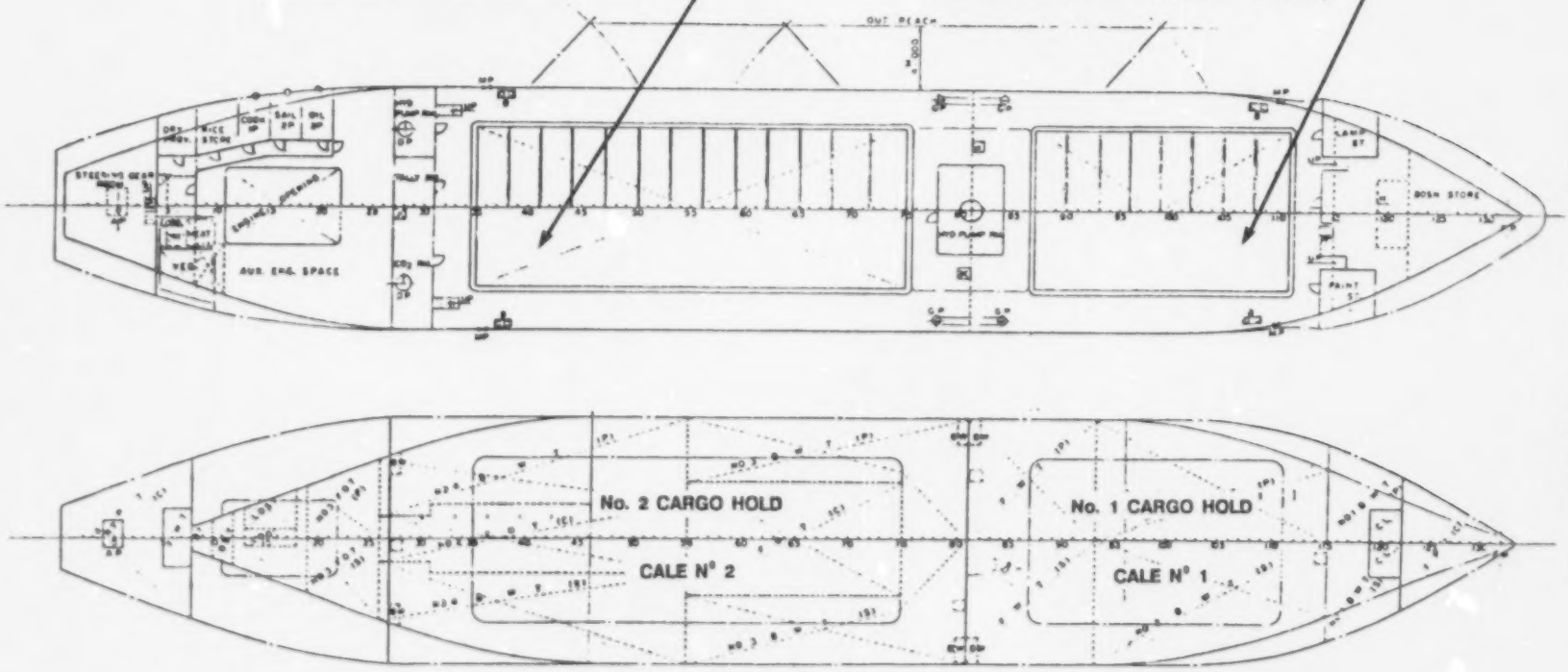
ANNEX IA

APPENDICE IA

"JOHANNA B"
PROFILE VIEW
SCALE 1:400

"JOHANNA B"
VUE DE PROFIL
ÉCHELLE 1:400

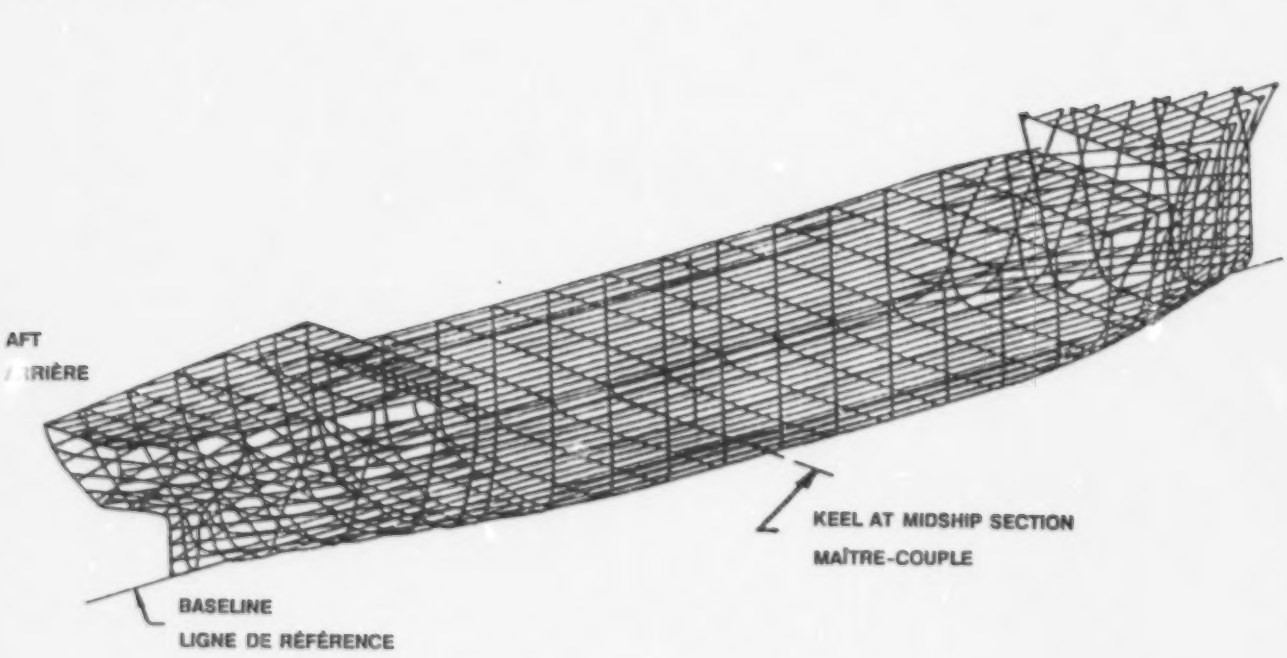



No. 2 CARGO HATCH
L X B 26M.00 X 10M.00
(PONTOON TYPE HATCH COVER)
ÉCOUTILLE DE CALE N° 2
L X 1 26M.00 X 10M.00
(PANNEAU D'ÉCOUTILLE DE TYPE 'PONTON')
No. 1 CARGO HATCH
L X B 15M.60 X 10M.00
(PONTOON TYPE HATCH COVER)
ÉCOUTILLE DE CALE N° 1
L X 1 15M.60 X 10M.00
(PANNEAU D'ÉCOUTILLE DE TYPE 'PONTON')
No. 2 CARGO HOLD
CALE N° 2
No. 1 CARGO HOLD
CALE N° 1

PLAN VIEW VUE DES PLANS

FORM DIAGRAM
AXONOMETRIC VIEW

PLAN DES FORMES
VUE AXONOMÈTRIQUE



SCALE 1:400 ÉCHELLE 1:400

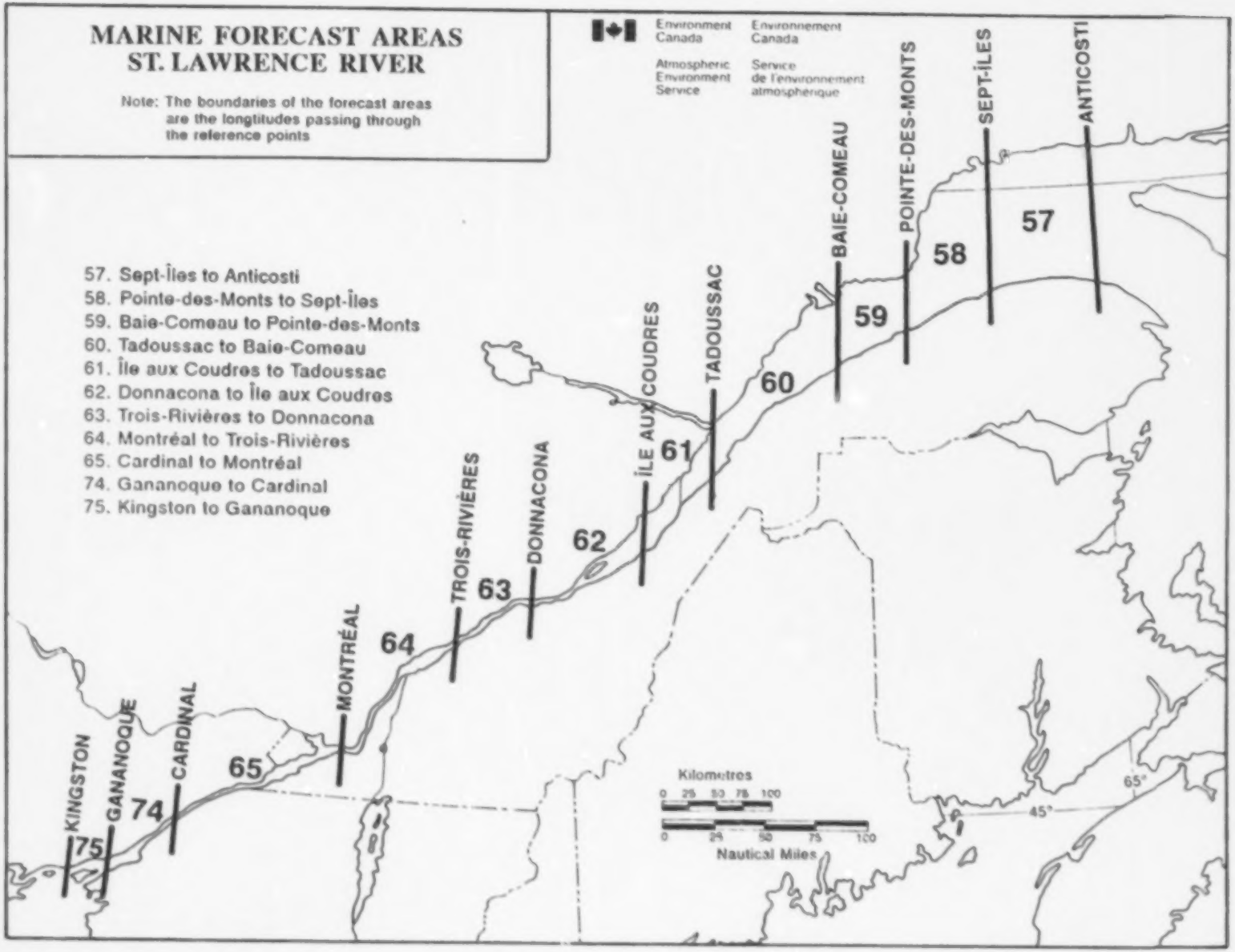
MARINE FORECAST AREAS
ST. LAWRENCE RIVER

Note: The boundaries of the forecast areas are the longtitudes passing through the reference points

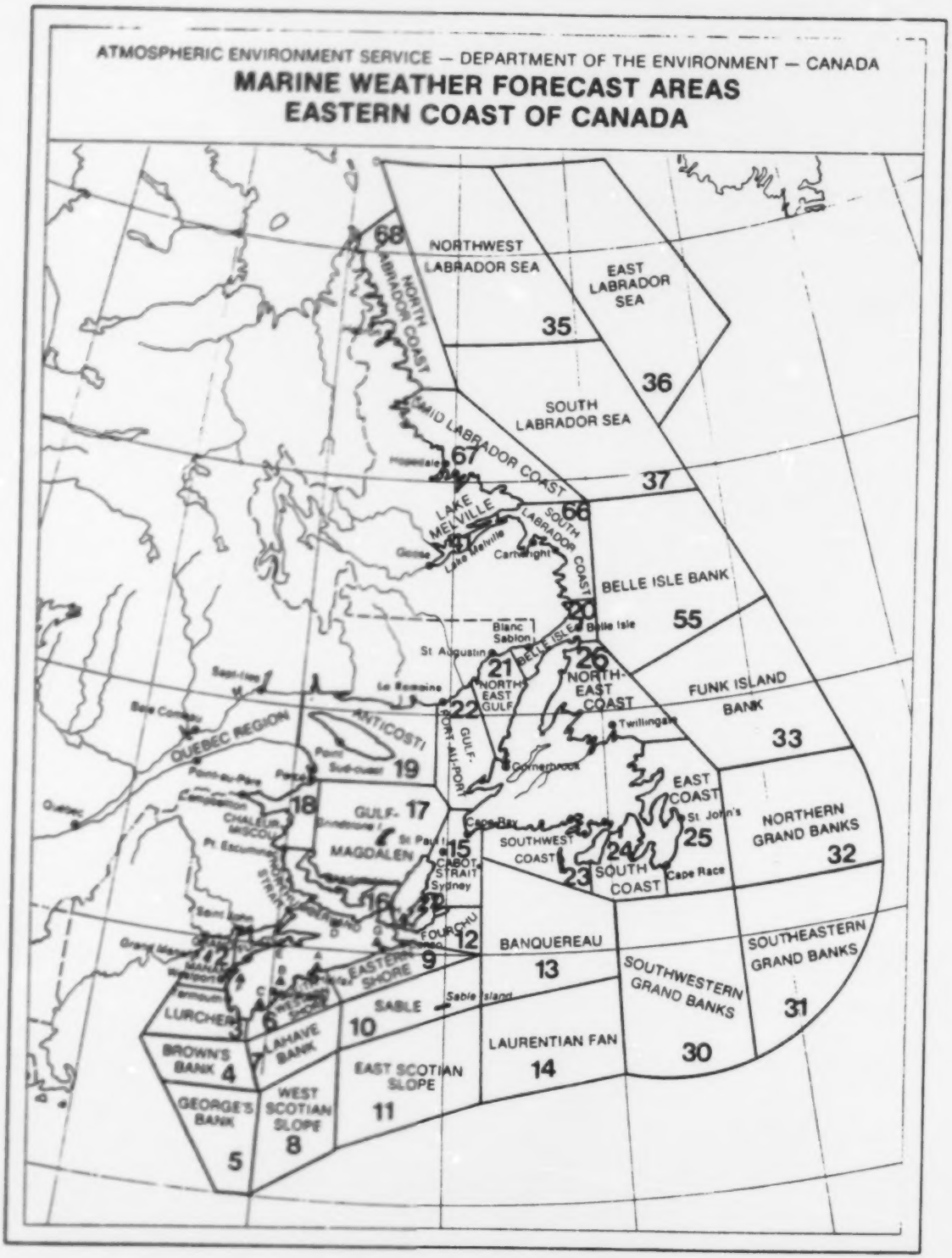
Environment Canada / Environnement Canada

Atmospheric Environment Service / Service de l'environnement atmosphérique

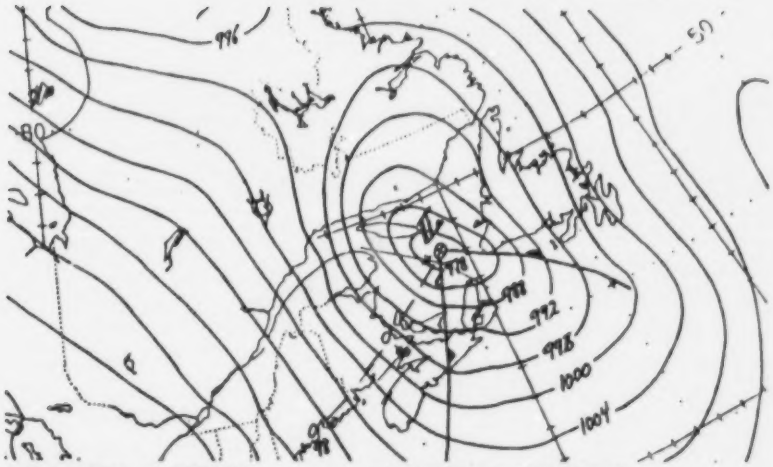
57. Sept-Îles to Anticosti
58. Pointe-des-Monts to Sept-Îles
59. Baie-Comeau to Pointe-des-Monts
60. Tadoussac to Baie-Comeau
61. Île aux Coudres to Tadoussac
62. Donnacona to Île aux Coudres
63. Trois-Rivières to Donnacona
64. Montréal to Trois-Rivières
65. Cardinal to Montréal
74. Gananoque to Cardinal
75. Kingston to Gananoque



ANNEX IIB


ATMOSPHERIC ENVIRONMENT SERVICE — DEPARTMENT OF THE ENVIRONMENT — CANADA
MARINE WEATHER FORECAST AREAS
EASTERN COAST OF CANADA
NORTHWEST LABRADOR SEA
35
EAST LABRADOR SEA
36
SOUTH LABRADOR SEA
37
NORTH LABRADOR COAST
68
MID LABRADOR COAST
67
LAKE MELVILLE
66
SOUTH LABRADOR COAST
20
BELLE ISLE BANK
55
BELLE ISLE
21
NORTH-EAST GULF
22
NORTH-EAST COAST
26
FUNK ISLAND BANK
33
GULF-PORT-AU-PORT
ANTICOSTI
19
QUEBEC REGION
18
GULF-MAGDALEN
17
15
CABOT STRAIT
16
SOUTHWEST COAST
24
SOUTH COAST
23
EAST COAST
25
NORTHERN GRAND BANKS
32
FOURCHU
12
BANQUEREAU
13
EASTERN SHORE
9
SOUTHWESTERN GRAND BANKS
30
SOUTHEASTERN GRAND BANKS
31
LURCHER
3
SABLE
10
LAURENTIAN FAN
14
LAHAVE BANK
7
BROWNS BANK
4
EAST SCOTIAN SLOPE
11
GEORGES BANK
5
WEST SCOTIAN SLOPE
8

ANNEX III APPENDICE III

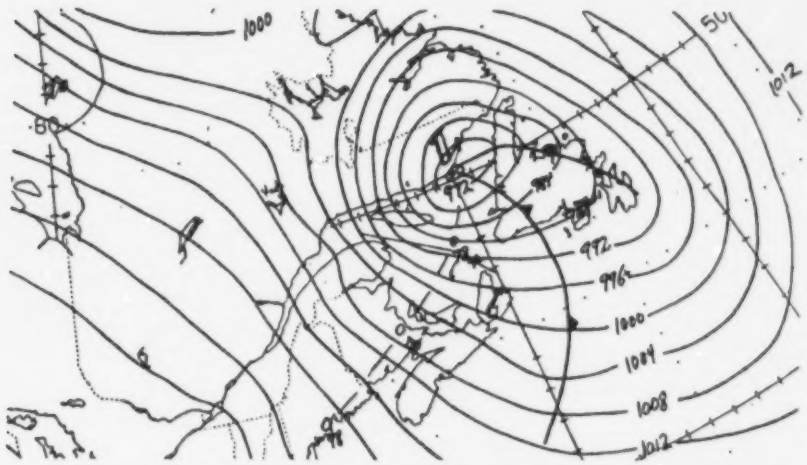


DECEMBER 7, 14:00

7 DÉCEMBRE 14:00

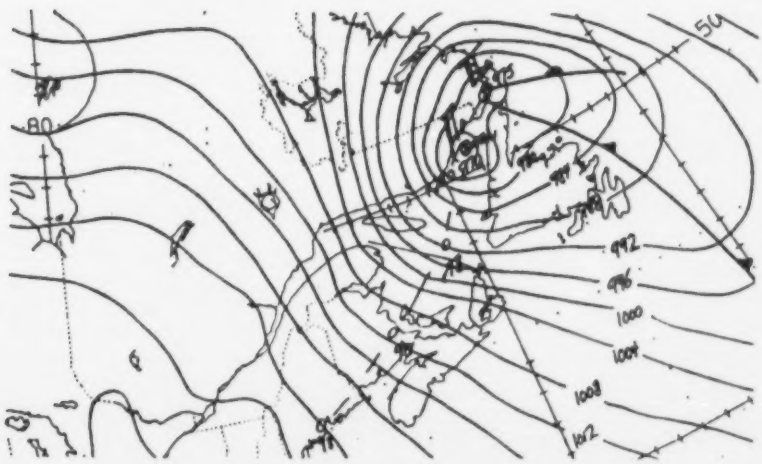
INDICATES POSITION OF THE LOW

INDIQUE LA POSITION DE LA BASSE PRESSION



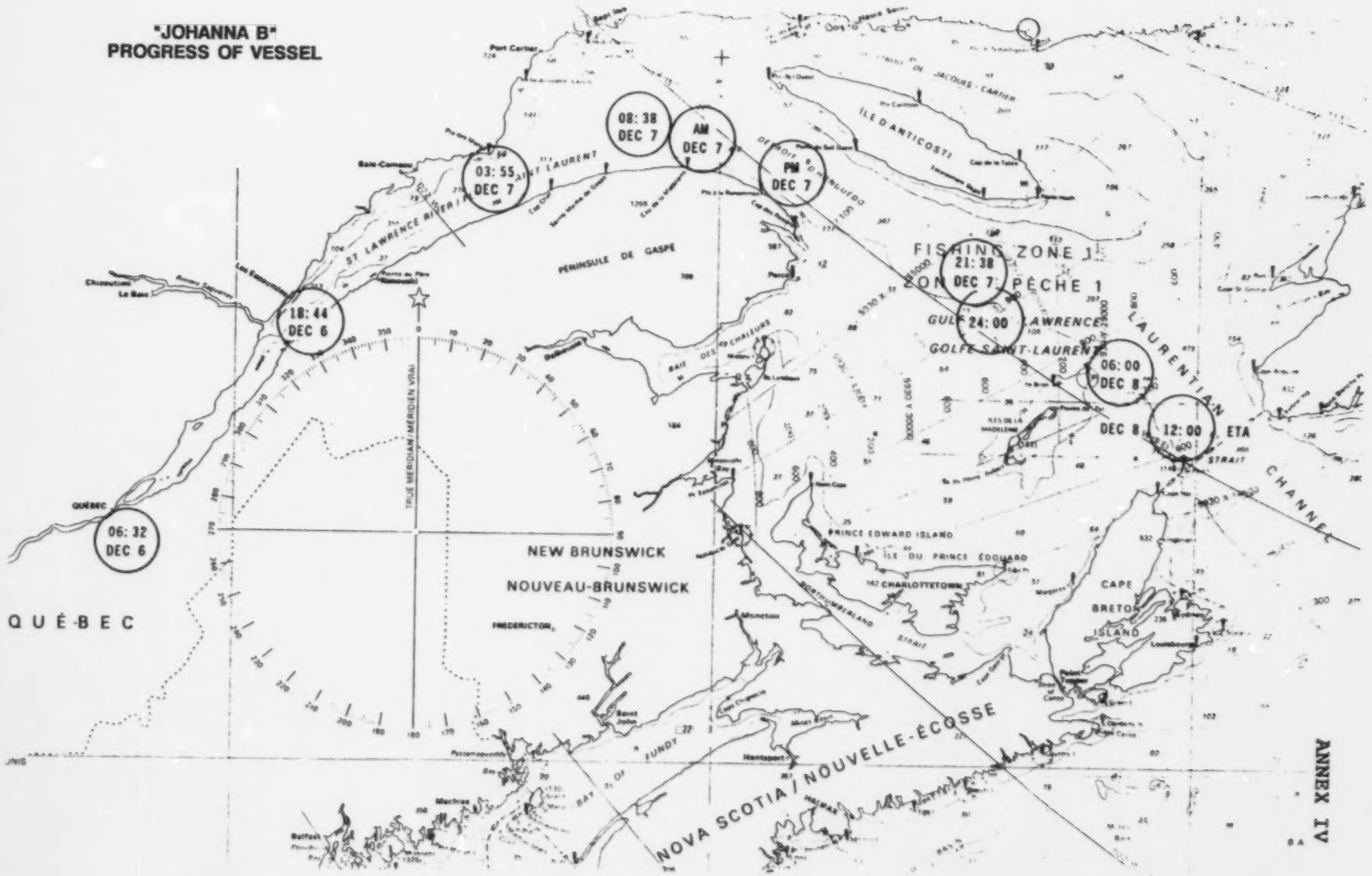
DECEMBER 7, 20:00

7 DÉCEMBRE 20:00

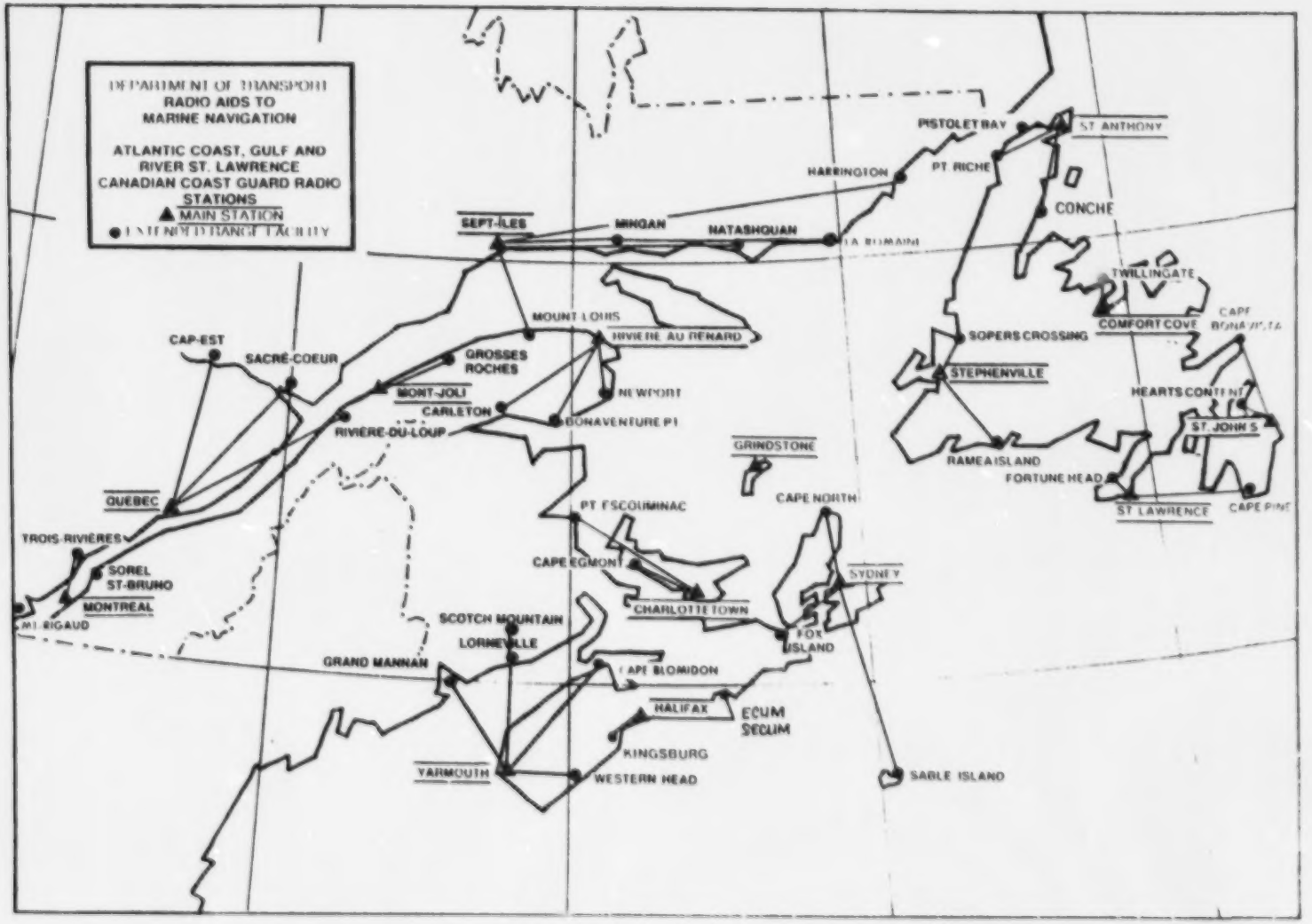


DECEMBER 8, 02:00

8 DÉCEMBRE 02:00


"JOHANNA B"
PROGRESS OF VESSEL
06: 32
DEC 6
18: 44
DEC 6
03: 55
DEC 7
08: 38
DEC 7
AM
DEC 7
PM
DEC 7
21: 38
DEC 7
24: 00
06: 00
DEC 8
12: 00
DEC 8
ETA
FISHING ZONE 1
ZONE DE PÊCHE 1
PENINSULE DE GASPE
ST LAWRENCE RIVER / ST LAURENT
GULF OF ST LAWRENCE
GOLFE SAINT-LAURENT
LAURENTIAN CHANNEL
PRINCE EDWARD ISLAND
ILE DU PRINCE ÉDOUARD
NEW BRUNSWICK
NOUVEAU-BRUNSWICK
QUÉBEC
CAPE BRETON ISLAND
NOVA SCOTIA / NOUVELLE-ÉCOSSE
FUNDY
TRUE MERIDIAN / MÉRIDIEN VRAI

ANNEX IV


DEPARTMENT OF TRANSPORT
RADIO AIDS TO
MARINE NAVIGATION
ATLANTIC COAST, GULF AND
RIVER ST. LAWRENCE
CANADIAN COAST GUARD RADIO
STATIONS
▲ MAIN STATION
● INTERMEDIATE FACILITY
PISTOLET BAY
ST ANTHONY
HARRINGTON
PT RICHE
CONCHE
SEPT-ÎLES
MINGAN
NATASHQUAN
TWILLINGATE
MOUNT LOUIS
RIVIERE AU RENARD
COMFORT COVE
CAPE BONAVISTA
CAP-EST
SACRÉ-COEUR
GROSSES ROCHES
SOPERS CROSSING
STEPHENVILLE
MONT-JOLI
NEWPORT
HEARTS CONTENT
CARLETON
BONAVENTURE PT
RIVIÈRE-DU-LOUP
ST JOHN'S
GRINDSTONE
RAMEA ISLAND
FORTUNE HEAD
QUÉBEC
PT ESCOUMINAC
CAPE NORTH
ST LAWRENCE
CAPE PINE
TROIS-RIVIÈRES
CAPE EGMONT
SYDNEY
SOREL
ST-BRUNO
CHARLOTTETOWN
MONTREAL
MT RIGAUD
SCOTCH MOUNTAIN
FOX ISLAND
LORNEVILLE
GRAND MANNAN
CAPE BLOMIDON
HALIFAX
ECUM SECUM
KINGSBURG
YARMOUTH
WESTERN HEAD
SABLE ISLAND

ANNEX V

ANNEX VI

SURFACE UNITS DEPLOYED BY SAR

NGCC "SIR WILFRED GRENFELD"
NGCC "SIMON FRASER"
NGCC "EARL GREY"
NGCC "MARY HICHENS"
P & O "LADY HAMMOND"

VESSELS TRANSITING THROUGH THE GULF ST. LAWRENCE AND MOBILIZED BY SAR

"CONTI FORTUNE"
"CAST HUSKY"
"NORTHERN PIONEER"
"ARUM T"
"CITADEL HILL"
"KONSTAN TINOVKA"
"KAMENARI"
"KAPITAN DIMOV"

AIRCRAFT DEPLOYED BY SAR

Aurora 101
Aurora 108
Buffalo 453
Buffalo 455
Buffalo 459
Tracker 157
Tracker 168
Tracker 173
Tracker 183
Labrador 302

ANNEX VII

JOHANNA B

CONDITION: DEPARTURE FROM SOREL ON DECEMBER 3, 1989 WITH THE CONSIGNED CARGO, WITH A DISCREPANCY OF 44.38 TONS.

DETAILS	WEIGHT (TONS)	KG C.G.V. (METRES)	VERTICAL MOMENT	C.G.L. PER ℄ REPORT AT ⊠ (METRES)	LONGI-TUDINAL MOMENT	FREE ✓ SURFACE MOMENT
CREW & EFFECTS	2.64	11.59	30.60	29.52	77.93	0
STORES	5.00	9.10	45.50	1.00	5.00	0
MISCELLANEOUS OIL & WATER	27.98	8.73	244.27	27.65	737.65	0
FRESH WATER (P & S)	25.00	0.21	5.25	(-13.70)	(-342.50)	370.60
BUNKER (C)	86.12	0.66	56.84	16.05	1382.23	98.41
DIESEL OIL	13.74	0.28	3.85	28.12	386.37	49.70
LUBRICATING OIL (C)	1.02	0.14	0.14	32.86	33.52	0.64
LUBRICATING OIL (P)	2.89	0.45	1.30	32.47	93.84	1.93
WEIGHT DISCREPANCY	44.38	6.79	301.34	7.46	331.07	
HOLD No. 1	1891.56	2.700	5107.21	(-19.587)	(-37049.99)	
HOLD No. 2	2720.25	2.500	6800.63	7.883	21443.7	
WATER IN HOLD No. 2						
LIGHT SHIP	1509.70		10249.84	5.94	8967.74	
WEIGHT DISPLACEMENT	6330.28	3.609	22846.77	-0.616	-3897.41	721.28

HYDROSTATIC PROPERTIES:

IN FRESH WATER WITH A POSITIVE TRIM OF 0.52°

DRAUGHT AT CENTRE LINE	6.481 M
LONGITUDINAL CENTRE OF BUOYANCY	-0.647 M
VERTICAL CENTRE OF BUOYANCY	3.389 M
TONS OF IMMERSION PER CENTIMETRE	10.96
LONGITUDINAL POSITION OF CENTRE LINE FLOTATION	0.994 M
MOMENT TO CHANGE TRIM BY 1°	9407.48
LONGITUDINAL HEIGHT OF THE METACENTRE (KML)	85.15 M
TRANSVERSE HEIGHT OF THE METACENTRE (KMT)	6.215 M

FREE SURFACE EFFECT

721.28 TM = 0.114M
6330.28 T

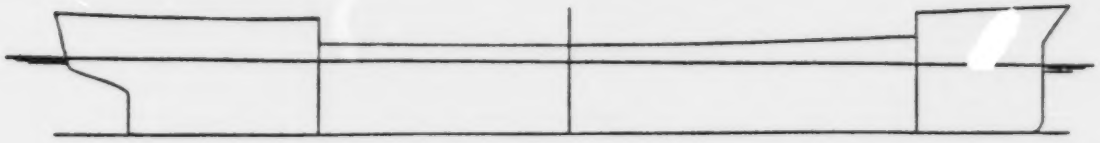
KMT	6.215 M	DRAUGHT	(FRESH WATER)	(SEA WATER)
KG	3.609 M	FORE	6.090 M	5.92 M
GM (SOLID)	2.606 M	AFT	6.858 M	6.730 M
FREE SURFACE	0.114 M	KEEL AT MIDSHIP SECTION	6.473 M	6.332 M
GM (LIQUID)	2.492 M	POSITIVE TRIM	0.52°	0.55°
KG (LIQUID)	3.723 M	FREEBOARD	1.360 M	1.501

1 ℄ positive AFT of the centre section
2 ✓ corrected for density

ANNEX VIII

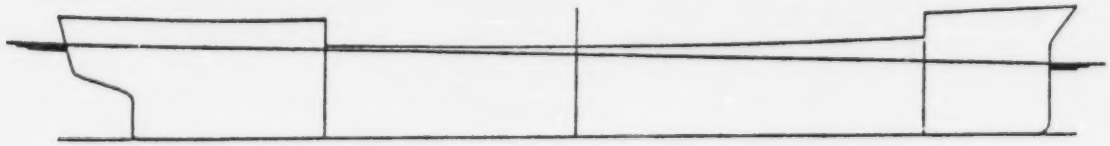
"JOHANNA B"
PROFILE VIEW
SCALE 1:400

DEPARTURE-POSITIVE TRIM 0.52° - MIN. FREEBOARD 1.501 M



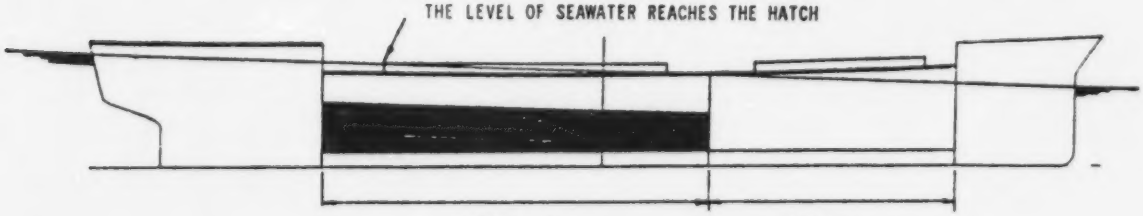
1.0 WATER IN HOLD No. 2 - POSITIVE TRIM 0.74° - MIN. FREEBOARD 1.171 M

3.0 M WATER IN HOLD No. 2 - POSITIVE TRIM 1.37° - MIN. FREEBOARD 0.083 M



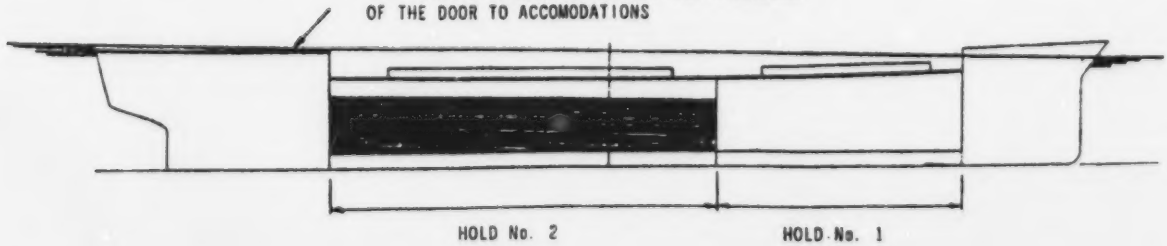
4.1 M (1900 TONNES) OF SEAWATER IN HOLD No. 2 - POSITIVE TRIM 2.60°

THE LEVEL OF SEAWATER REACHES THE HATCH

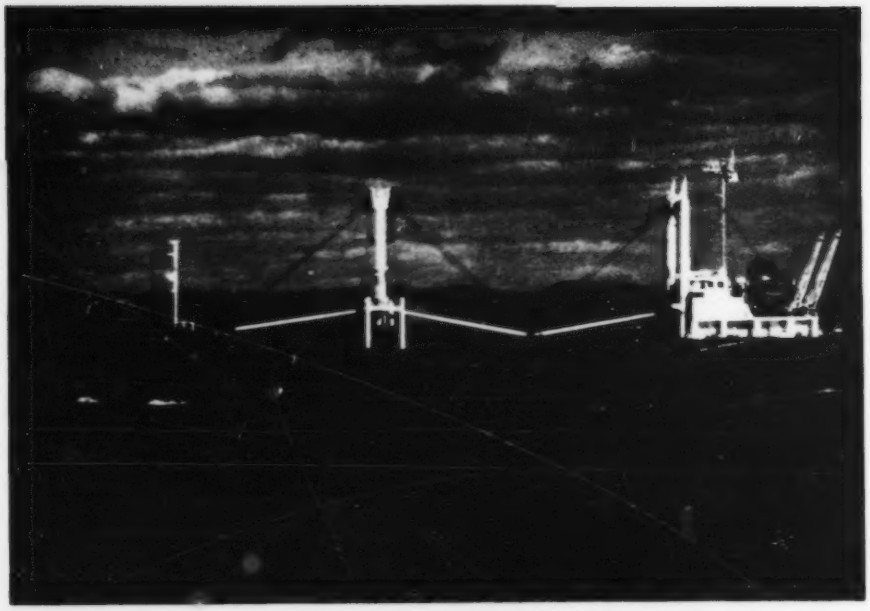


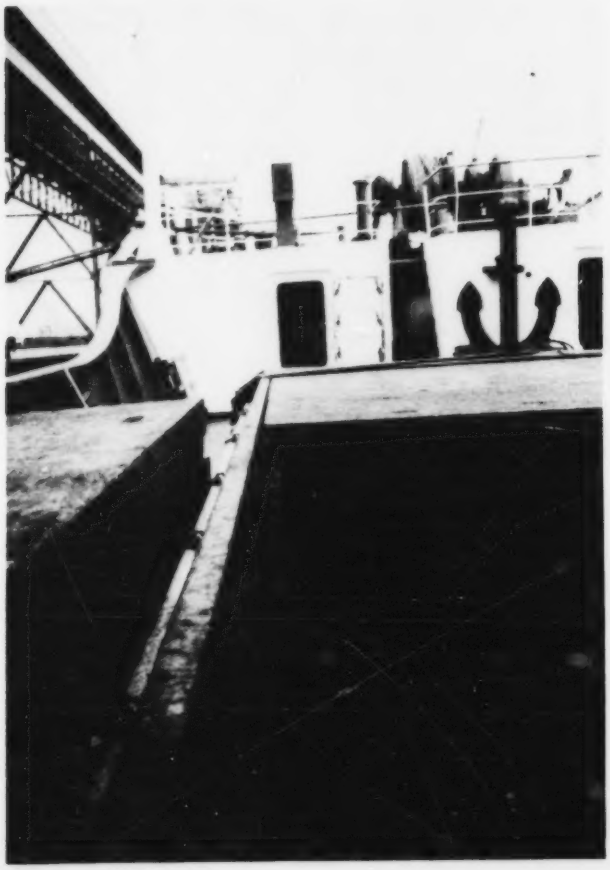
5.2 M (2550 TONNES) OF SEAWATER IN HOLD No. 2 - POSITIVE TRIM 2.60°

THE LEVEL OF SEAWATER REACHES THE THRESHOLD OF THE DOOR TO ACCOMODATIONS



"JOHANNA B"



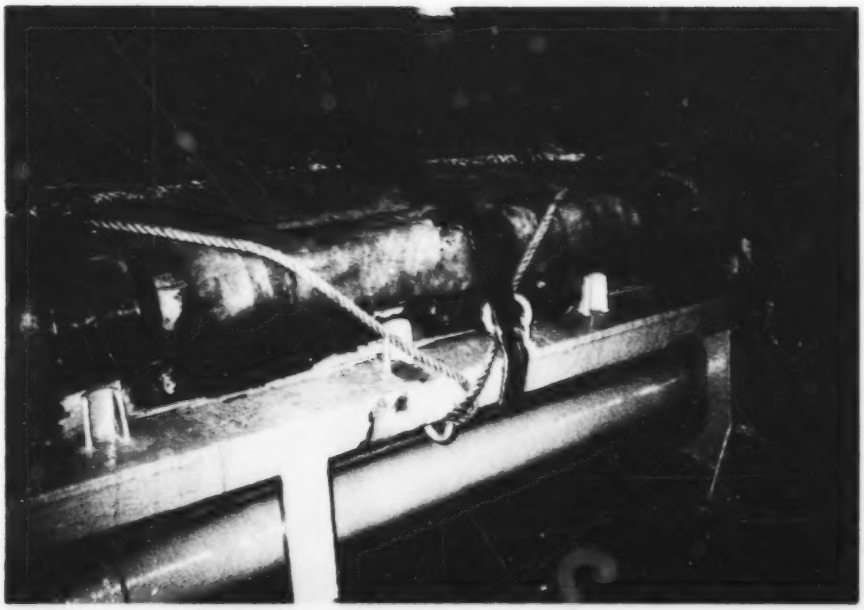


Pontoon in position
in the hatchway.
Note: The gap on the port side
between the pontoon
edge and the hatchway.

Ponton en place sur
le carré d' écoutille.
Nota: L' interstice à bâbord
entre le pourtour du
ponton et le carré
d' écoutille.

Sister vessel "SECIL CONGO". Hatch closing and pontoon securing arrangement. Hatch covered with three tarpaulins, cleats to fit tapered wedge.

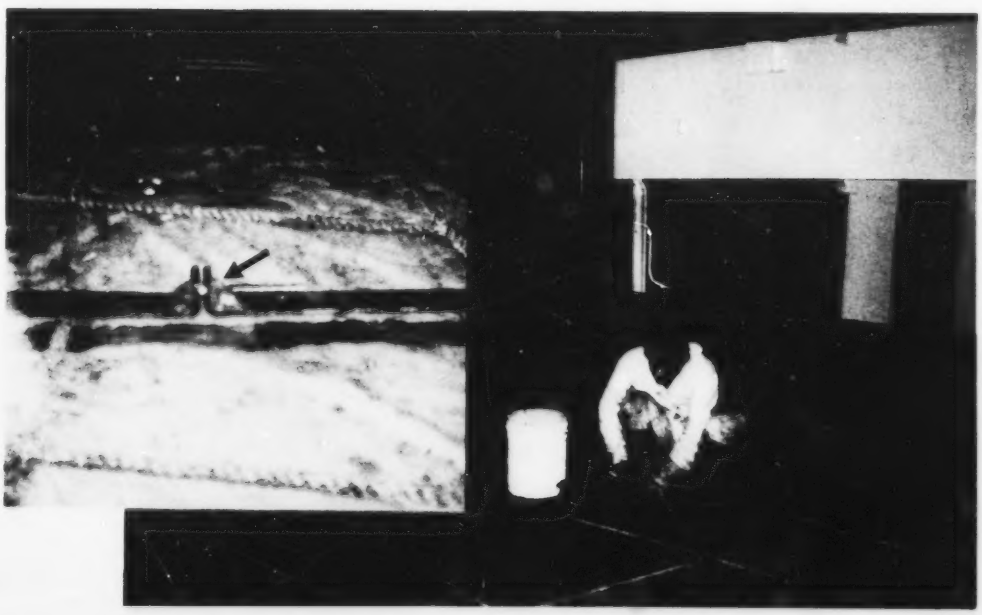
Navire-jumeau "SECIL CONGO". Fermeture des écoutilles et disposition pour l'arrimage des pontons. L'écoutille est recouverte de trois préharts assujettis par des tringles et des coins encastrés.



Nets laid on top of tarpaulins followed by locking bars.
Note: One end of locking bar and net secured to the coaming.

Des filets recouvrent les préharts lesquels sont assujettis par des barres d'acier.
Nota: Un bout de la barre d'acier et le filet sont assujettis de chaque côté du surbau.

Tarpaulin secured at the corner of the hatch.
Préharts sont assujettis au coin des écoutilles.



Crewmember securing a bolt to the locking bars.
Inset: Close-up of nut/bolt arrangement.

Un membre d'équipage fixe un boulon sur les barres d'acier.
Cartouche: Gros plan d'un boulon/écrou.

Access hatch to No. 2 hold after part located forward of accommodation on the main deck.

Écoutillon placé contre la cloison des emménagements sur le pont principal donnant accès à la partie arrière de la cale N° 2.